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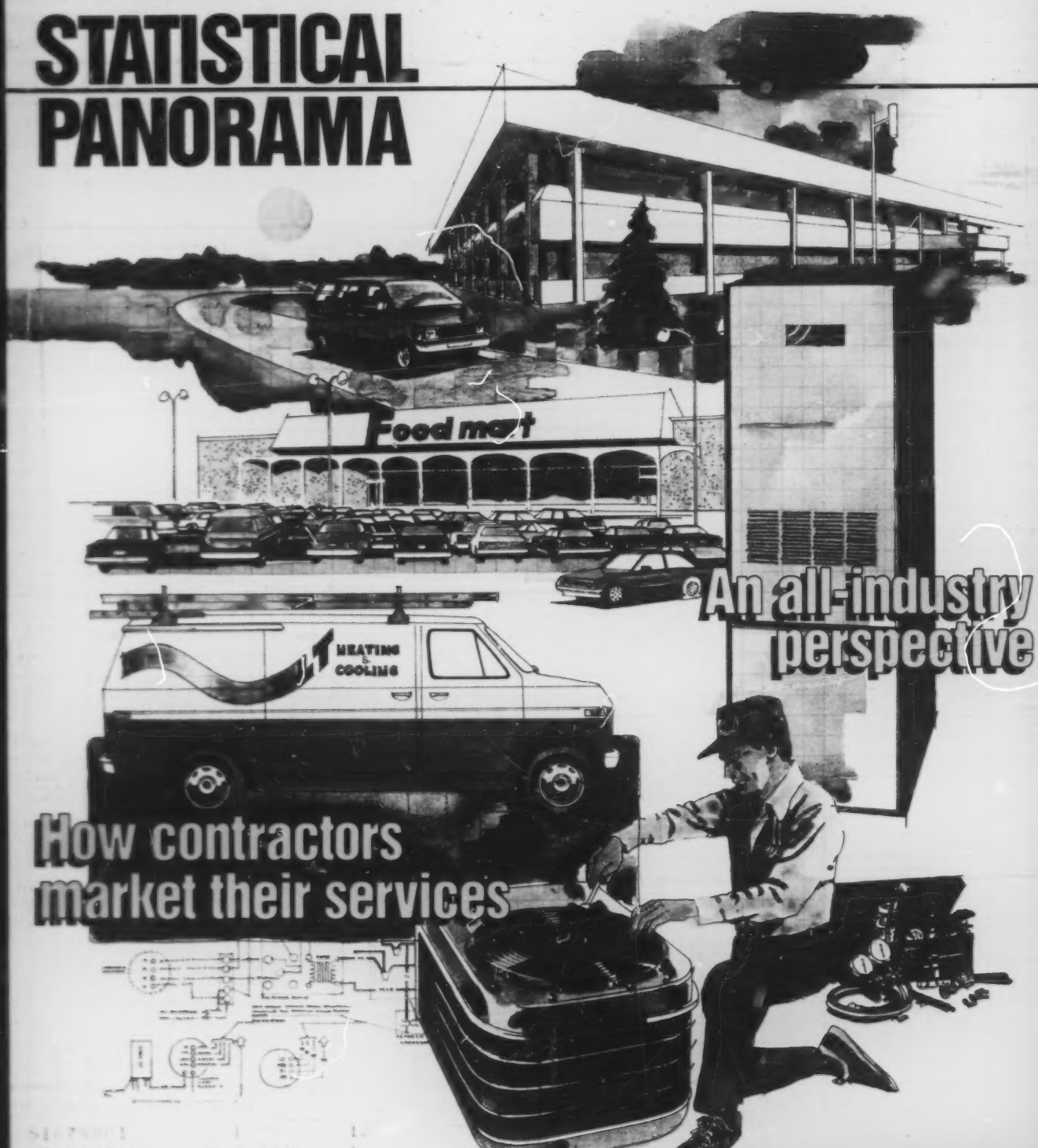

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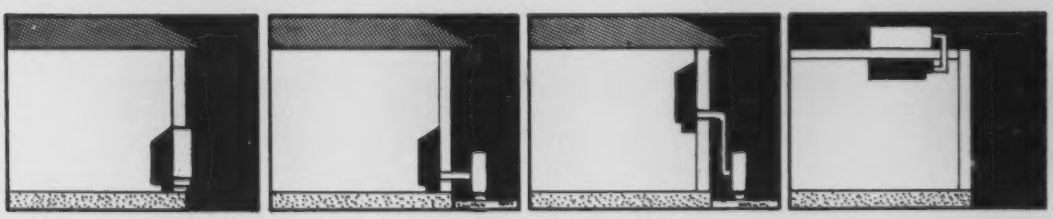

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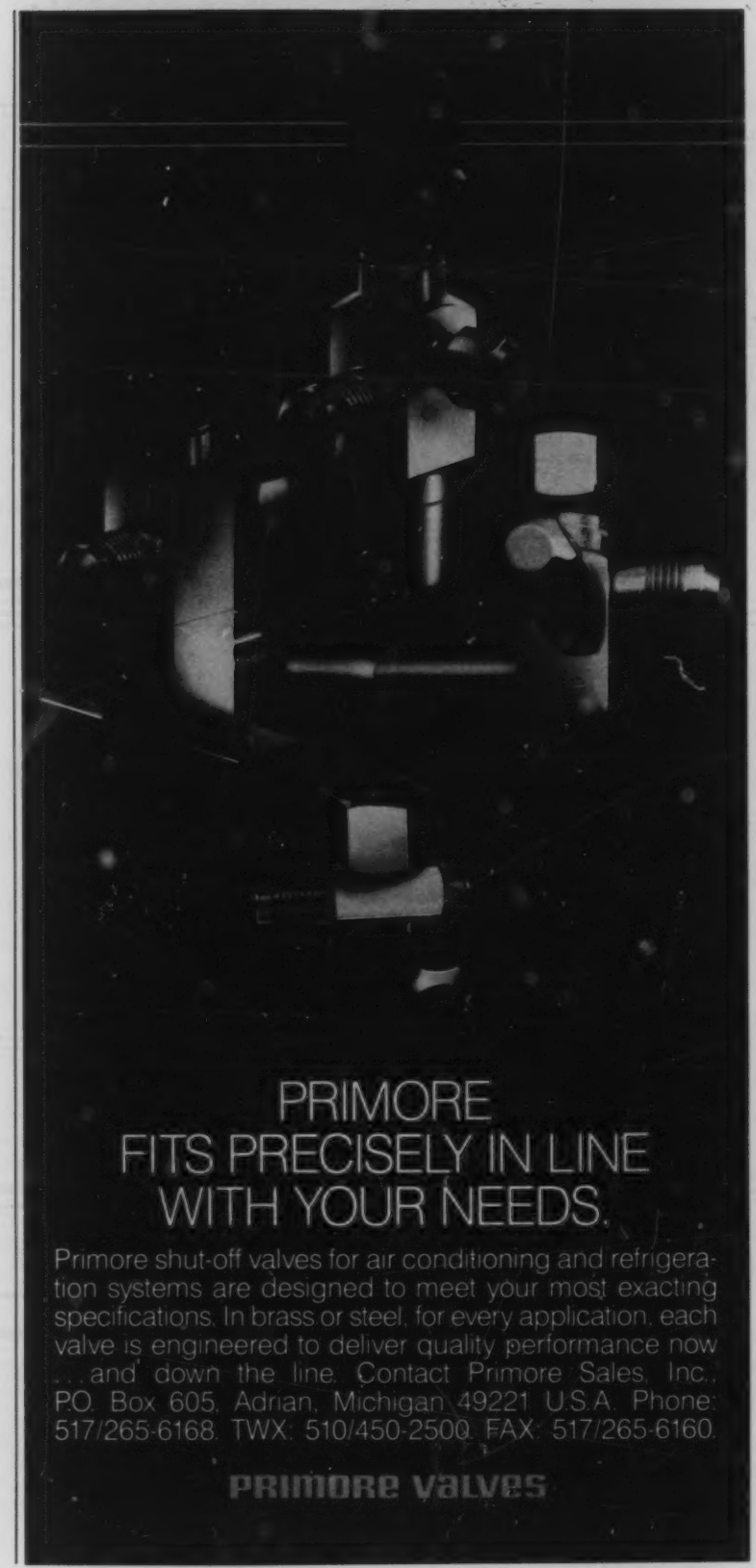
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FORECASTS

by Gordon D. Duffy and Thomas A. Mahoney

AIR CONDITIONING

Weather and replacement growth played important roles in producing last year's record shipments. Even though it's possible, we can't count on the weather for an encore. That, plus a further drop in multifamily starts, influences us to look for a total of 3.8 million units this year, down 4%. Still a great year by any measure.

HEAT PUMPS

After setting records for the past four years in a row, heat pump shipments in 1988 should drop by about 6% to 860,000 units. The surprising surge in replacement sales, which helped produce a 918,413-unit record, won't be enough to overcome the doldrums in the South's new-home market or the replacements for reasons of efficiency.

FURNACES

Total gas, oil, and electric furnace shipments in 1987, at 2.65 million, were within a whisker of the previous year's record level. So when we call for a flat year for this market segment in 1988, there's no doubt that the plateau is at a high point. Each of the three segments, although they vary sharply in relative size, is showing significant strength. Any declines should be minimal.

BOILERS

Gas- and oil-fired boilers have come a long way from the recession of 1982. Part of the story has been the strong new home market in the Northeast and part has been effective industry promotion. Last year's shipment level, at 356,466 units, will be hard to beat in the face of a temporary decline in Northeast home starts. But the steady replacement market will keep the total even in 1988.

CHILLERS

Thanks to steady replacements and strong institutional-government building markets, shipments of chillers increased by 5% in 1987, a year when a decline of twice that magnitude was forecast. Office construction continues slow, however. But, on the strength of other markets, we see the drop this year being held to about 2%. Export sales are beginning to come back but it will be a long time, if ever, before they return to pre-hard dollar days.

ROOM AIR CONDITIONING

The successive heat waves that rolled across the Midwest and Northeast last summer created a boom market for room air conditioners, one of the few impulse purchase products in the hvac arsenal. But, alas, the 3.8 million units produced in the U.S. — up nearly 35% — were not the whole story. An additional 697,400 units, up 85% from the year before, were imports. Growing imports and a lack of weather guarantees add up to a 1988 total of about 3,230,000 units, down 15%.

COMMERCIAL REFRIGERATION

The market for commercial refrigeration equipment, although never spectacular, has almost always been steady. Low profitability and intense competition among the nation's supermarkets has meant that older stores must constantly be upgraded. This renovation market, together with a stable new construction segment, led to a 1.4% increase last year, or 108,800 units. Look for real growth in 1988 of about 1% to about 110,000 units.

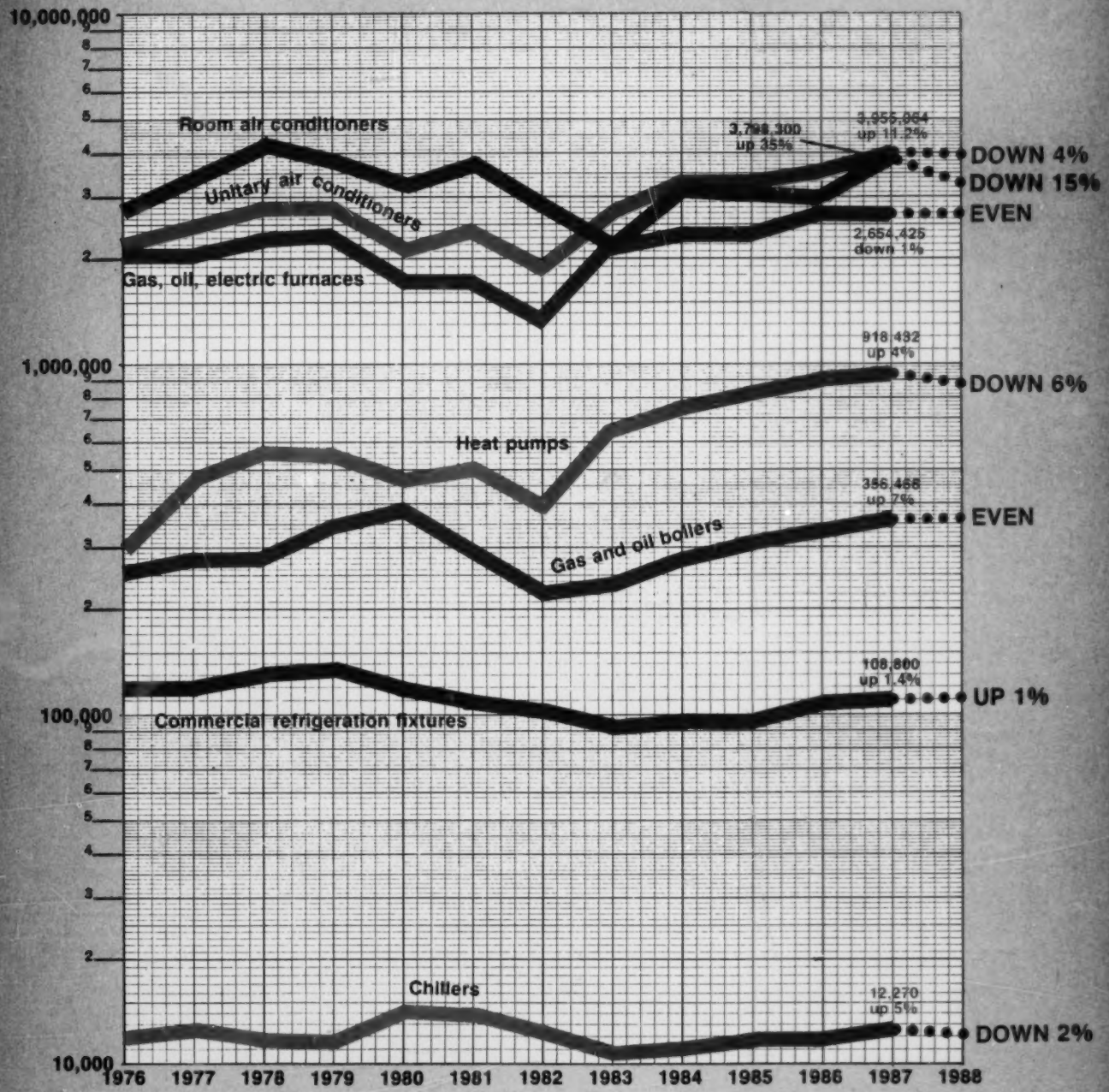
HOUSING

The 10.5% drop in new home starts last year was attributable mostly to the 24.5% decline in multifamily starts. Single-family homes almost held the line and, in 1988, should do the same. But multifamily units, hampered by continued softening in the rental sector, will drop back again. We look for 1,125,000 single-family and 400,000 multifamily starts this year for a total of 1,525,000 units, down 5.5% from 1987 performance.

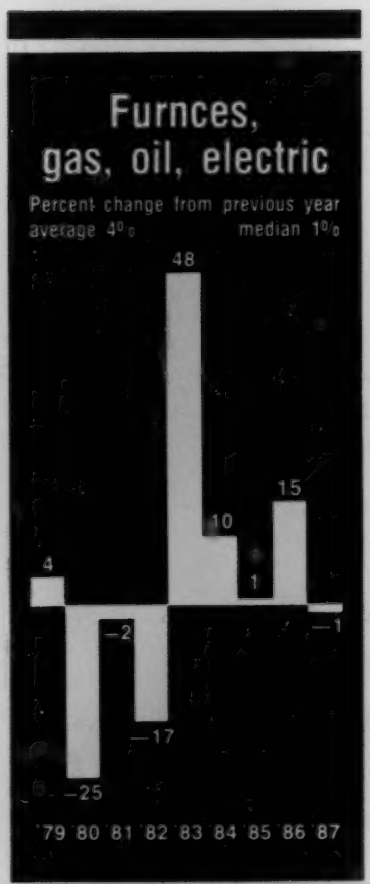
REPLACEMENTS

The replacement of worn-out or inefficient heating and cooling equipment has become more and more important for both contractors and manufacturers. This is especially true for central air conditioners and heat pumps, latecomers to the volume replacement scene. We figure that 24% of heat pumps and 42% of central air conditioner shipments last year were replacements. This is in contrast with 60% of gas furnaces, 80% of oil furnaces, and three out of four residential boilers. As a result, much more emphasis is being placed on contractor marketing practices as a means of uncovering those who will replace inefficient units in good working order with today's more efficient products.

Industry trends



1988 IN PERSPECTIVE



Against a backdrop of agonizingly slow national economic growth, a major calamity in the stock market, and weakness in important new construction market segments and geographic areas, activity in the comfort heating-cooling and refrigeration industries was sustained at high levels in 1987.

As the industry moves through 1988, the sixth year of expansion since the 1982 recession, there are few prospects for real growth among the industries served by The News. But any declines should be modest. And as the economy continues its slow upward pace, the specter of the next recession again has been pushed beyond the horizon.

There are many positive factors at work this year.

The stock market, after the shock of October 19, appears to have stabilized at more realistic levels. Importantly, its effect on the overall economy has been minimal. It may, in fact, have warded off a recession. Industrial production has picked up. Exports, both in agricultural products and manufactured goods, are moving ahead briskly.

Consumer debt still is high, savings levels low, but confidence is growing. The positive effects of the new tax law should take full effect this year, an important consideration for the replacement market. And new construction continues to show surprising strength in the face of overbuilding in several areas of the country.

Interest rates still are too high — held captive by a federal deficit Congress has been unable to deal with effectively and the need for a continuing inflow of foreign capital. The trade deficit, although now headed in the right direction under the impetus of a softer dollar in many world markets, also is a long-term economic problem.

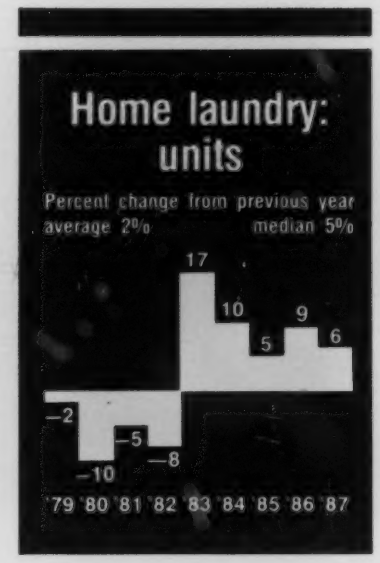
Inflation continues to be held in check. Slow economic growth and relatively high interest rates should curb any excessive increase. And, in an election year, it's unlikely federal government policies will rock the nation's economic boat. Unemployment continues to spiral downward slowly.

Even though the boom in the Northeast, Southeast, and Midwest construction markets has slackened a bit, the

declines this year should be modest. The economies of the oil-producing states in the South are showing signs of recovery but construction, in the face of much overbuilding, will be slow coming back. Recovery should be more rapid among the states that depend heavily on agricultural exports.

Behind all of these expectations is the steady but unspectacular replacement market. It's been a stabilizing influence in the mature comfort heating and refrigeration markets for many years. Its impact on the comfort cooling and heat pump markets has been appreciated only since the mid 1980's.

Last year, coupled with successive heat waves in the Northeast and Midwest and only a slight dip in new single-family home and light commercial construction, the replacement market for unitary air conditioner and heat pump shipments to record heights. Gas furnaces weren't far behind and, although they didn't match 1986 totals, recorded the second year in a row above 2 million units.



It was an exciting time. And although the records appear to be safe until the early 1990's, the combination of market forces promises to keep shipment levels within sight of those goals. Replacements should make up most of the new construction losses.

Because new home construction accounts for more than a third of shipments to the large residential market, its role in the comfort heating-cooling industry continues to be important. Last year's 10.5% drop in new home starts masked continuing regional disparities and a sharp difference between single-family and multifamily activity.

The 1.1 million single-family home starts last year represented only a 3% drop from 1986 performance but multifamily starts, largely because of an overbuilt rental market, dropped

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24.5%. Single-family starts continue strong but there has been a noticeable shift toward large, custom homes and away from more modest units.

Although condominium construction has retained much of its strength, particularly in the Northeast and Southeast, the building of rental apartments has fallen on tough times in most markets. Vacancy rates, which range from 4.1% in the Northeast to 11.2% in the South, average 8% and represent more than two years of normal new-unit production. And, by that time, demographics point to falling demand.

Regionally, the strong markets continue to be the Northeast, the Midwest, and parts of the Southeast, notably Florida and the area around the nation's capital. The South, which still accounts for more than four of 10 new home starts, still is declining at a much reduced rate. And in the West, California is the only bright spot.

Looking ahead, we expect new home starts this year will total 1,525,000 units, down 5.5% from 1987 performance. Single-family starts, at 1,125,000 units, should decline only by 1.6%. The drop in multifamily starts, at 15.5%, will be much more severe and, we expect, wind up at 400,000 units. Most of the decline will be rental apartments.

Light commercial construction, like housing, continues to be a bulwark for industries served by The News. In terms of new construction, this market held about even in real terms last year but promises to drop, possibly as much as 15%, in 1988. Replacements, however, should remove much of the sting.

Office construction held up surprisingly well in 1987 and a predicted 22% drop never materialized. Even though such markets as Dallas, Houston, and Denver still are much overbuilt, other markets scattered throughout the nation took up much of the slack.

The surplus 200 million sq ft of office space came about partly because of the collapse of oil prices in late 1985 and partly because of tax shelter-oriented syndicates with a commitment to build whether or not there was demand. The basis for these syndicates, which also operated in the rental apartment market, was wiped out by the Economic Recovery Tax Act of 1986.

Continuing demand for new office buildings in the Northeast, parts of the Southeast and Midwest, is not strong enough to carry the whole load in 1988. Expect a drop of 15% to 20% in this market, in real terms, this year.

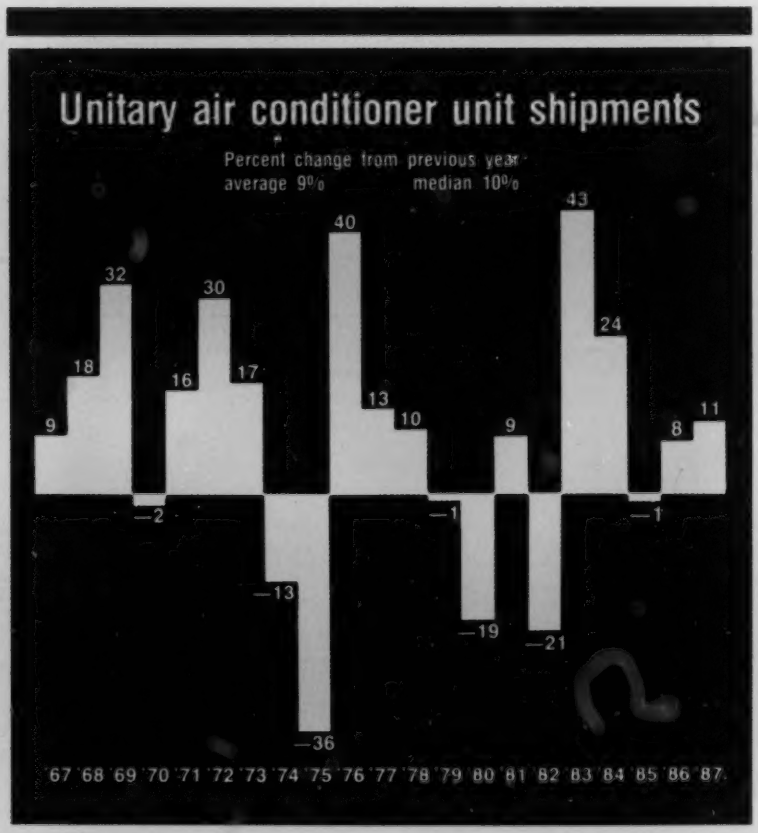
The market losses experienced by contractors and field-erected system component manufacturers in the office building market were compensated in large measure by the gains last year in the institutional and government buildings markets. Again, only marginal decreases in these markets are expected in 1988.

Industrial construction, too, is expected to continue the modest gains of 1987 throughout this year. Educational facility and hospital construction, which gained slightly last year, will experience a modest (4%) decline in 1988. Overall, nonresidential construction will represent an $89.5 billion market in 1988, down about 7% from last year.

Not to be forgotten either is the fact that replacements and renovation have become increasingly important segments in the nonresidential market as well. Even office building owners, eager to retain tenants in the face of high vacancy rates, have become major players. Both consulting engineers and design/build contractors report that as much as half of their work is renovation or replacements.

Helped by growing replacements, strong light commercial and single-family home demand, and a hot summer, total shipments of unitary air conditioners last year set a new record of 3,955,064 units — more than 400,000 above the record set only a year before. And heat pumps, at 918,432 units last year, set a record for the fourth year in a row.

The 11.2% increase for unitary air conditioners and 4% increase for heat pumps in 1987 probably led to a high-water mark for these products in this decade. Although the replacement markets for both central air conditioners and heat pumps are growing, it will not be enough to outdistance the



anticipated declines in housing and light commercial work. Only Mother Nature, in the form of sustained hot weather in early summer, could alter that prediction.

We expect that unitary air conditioner shipments will decline about 4% in 1988 to 3,800,000 units. It would make the fifth year in a row above the 3 million mark and well above the 3.52-million average for the past four years. Still a solid market.

The picture for heat pumps is not quite so rosy. We expect heat pump shipments will decline by 6% to about 860,000 units. But for a surge in the heat pump replacement market, it could be more. The main problem is the short-term stall in the housing market in the South, the heat pump's stronghold, and a slight decline in penetration in new single-family homes.

Both of these negative factors will be overcome, we believe, when home starts in the South rebound at the end of the decade. Even so, the prediction for this year is well above the 842,000 average shipments for the past four years.

The growing emphasis on custom homes, which some experts estimate account for a quarter of the single-family market, has brought about a reexamination of the new-replacement ratio. Some, including The News, estimate that as many as 16% of all single-family starts, involve multiple heating and cooling units to achieve zoning.

Replacements are a growing factor. We estimate that residential central air conditioner replacements accounted for more than one million units last year, or 42% of all cooling-only shipments. In the case of residential heat pumps, the 188,600 replacements last year was 24% of that market, up from only 11.5% a year earlier.

A result is that contractors are paying much more attention to their service business and to marketing programs that help smoke out potential efficiency upgrade customers. Manufacturers, on the other hand, are seeking ways to influence consumers and to get closer to the contractors selling to them.

Replacements also have become important in the light commercial market. We estimate that commercial rooftop shipments increased about 6% last year in a relatively flat market. Although light commercial new construction probably will drop by 7% or so in real terms this year, the impact of replacements -- which account for 40% of shipments -- could all but erase that decline.

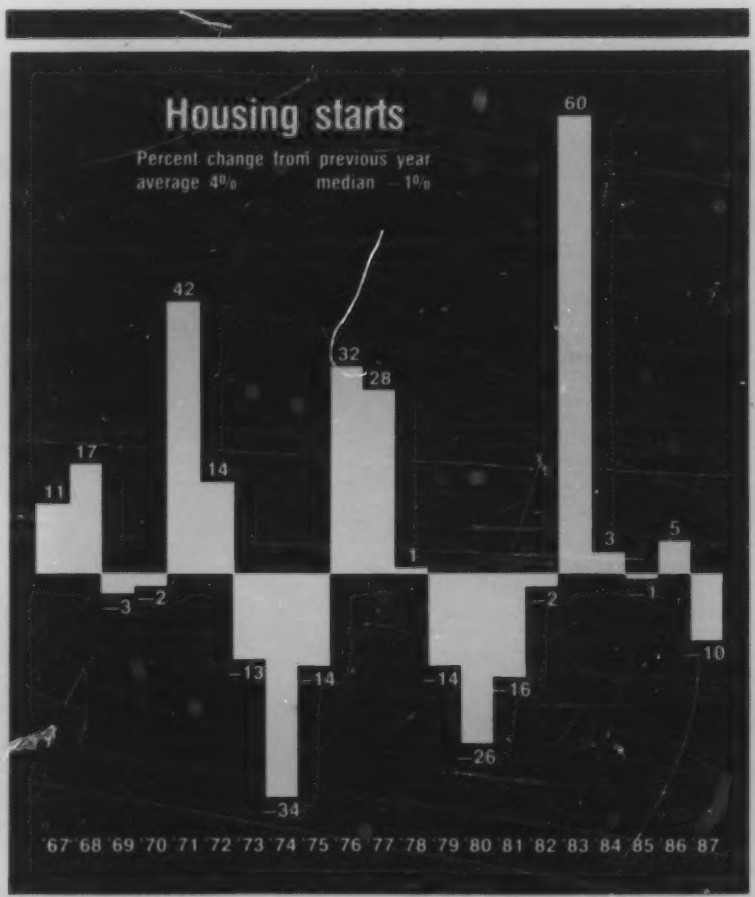
The declines in field-erected system components were considerably less than expected in 1987. Centrifugal chillers held their own and reciprocating chiller packages managed a small increase, thanks in large measure to the institutional and government building markets. Bookings indicate that the 1988 market should continue at or near this level.

The heat waves in the Northeast and Midwest last summer did wonders for the room air conditioner market. It increased by 34.9% to 3,798,300 domestic units. Added to that were 697,446 imports, up 85.6%. U.S. exports of room units, which increased slightly, still accounted for less than 3% of production. A decade ago exports routinely accounted for about 25% of domestic production.

Looking ahead, we can expect shipments of room units to drop about 15% this year to 3,230,000 units provided the summer is normal. Another hot summer, however, could boost shipments of this impulse-purchase product by as much as 25% to 30%.

Total gas-, oil-, and electric furnace shipments in 1987 totaled 2,654,425 units, down only 1.25% from the record set the previous year. The last two years have been the best for this product group since 1972.

The largest segment of the group, gas furnaces, topped out at 2,072,925 units last year, 1.5% below the record set only the year before. Oil furnace shipments increased by 2.9% last year for a more modest total of 206,445 units



largely because of the strength of the Northeast housing market. Electric furnace shipments declined by 2% to 375,055 units in a reflection of the doldrums being experienced in the South.

The 7% increase in the residential boiler market last year to 356,466 units was as much a reflection of increased penetration in the Northeast new home markets and increased promotion activities as it was replacement market strength.

Although the reasons are different, we can expect both the boiler and furnace markets to hold their own in 1988.

On the commercial side, the American Boiler Manufacturers Association expects commercial boiler shipments in 1988 to increase by 3.5%. The increase would follow a 8.4% decline in that market last year.

Even though the figures are somewhat sketchy, the commercial refrigeration market improved marginally last year. This stable market, the product of continuing supermarket new construction and remodels, also should show a modest improvement in 1988. Industrial refrigeration, too, has been continuing its steady, if not spectacular, pace.

Efficiencies

The specter of multiple leapfrogging state minimum efficiency standards for residential heating and cooling equipment was essentially removed in early 1987 with the passage of the National Appliance Energy Conservation Act.

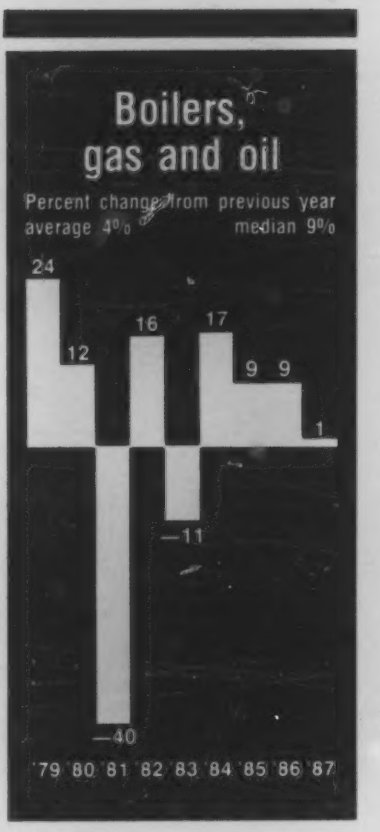
The legislation was the result of extended negotiations between the industry groups affected, environmental and consumer groups, and representatives of state agencies. It sets federal mandatory efficiency levels that become effective in the period 1990 through 1992 and should bring some order to what promised to be a fractionated marketplace.

Market forces already have brought average equipment efficiencies a considerable distance along the road to the coming federal minimums.

For example, in 1992, split-system air conditioners and heat pumps must have a minimum SEER (seasonal energy efficiency ratio) of 10. A year later, single-package units must have a minimum SEER of 9.7. In 1987, the sales-weighted average SEER for all air conditioners with capacities of 65,000 Btuh and under was 8.97, up from 8.87 a year earlier.

More than a third of the gas furnaces shipped in 1987 could meet the federal minimum of 78% AFUE (annual fuel utilization efficiency) effective in 1992. More than half (55.4%) of oil furnaces shipped last year had AFUE's of 80% or better, or more than double the number as early as 1984.

In the case of both central heating and cooling equipment there is no doubt that the technology is in place and the products are available to meet the minimums when they become effective. And while the growth of high-efficiency equipment sales has been less than swift over the past few years, neither has it faltered in the face of a substantial decline in fuel oil prices and relatively stable gas and electricity prices.



Replacements

Replacements, long an important fact of life in the older comfort heating markets, took on new meaning for those who make and install comfort cooling equipment when it became the largest market segment a few years ago. And its growth promises to continue.

In the case of heat pumps, the youngest member of the club, replacements have not been too important. In the past year, however, replacements accounted for nearly a quarter of the total residential units shipped.

The growing importance of replacements has influenced both contractors and manufacturers to place increasing emphasis on service and on marketing programs designed to uncover homeowners willing to replace equipment in good working order for reasons of efficiency.

Some have estimated that as many as 20% of central air conditioner and heat pump replacements are made to improve efficiency — and lower utility bills — rather than in response to major breakdowns. With heating equipment, that segment is probably half as high again. And a few are taking advantage of the still-important utility incentive programs to replace worn out split-system cooling-only units with heat pumps on gas- and oil-fired furnaces.

In 1986, the latest year for which complete figures are available, the Bureau of Labor Statistics and the Bureau of the Census reported that U.S. homeowners spent $91.274 billion on renovation and repairs.

The heating and air conditioning share of that market was $6.232 billion in 1986. Of that total, $3.399 billion was spent for major replacements — furnaces, boilers, central air conditioners, heat pumps. Significantly, 88% of all major replacements are made by contractors.

The percentage of replacements for the different product groups varies widely. For example, the unitary residential replacement share last year was 37.7% of shipments but two components of that share, comfort cooling at 42% and heat pumps at 24%, were quite different.

It should be noted here that we modified our figures for both 1986 and 1987 to reflect the number of custom homes that use multiple heating and cooling units to achieve zoning.

We estimate that 74.6% of the residential boilers shipped last year were replacements, a ratio that has eroded in the the face of greater

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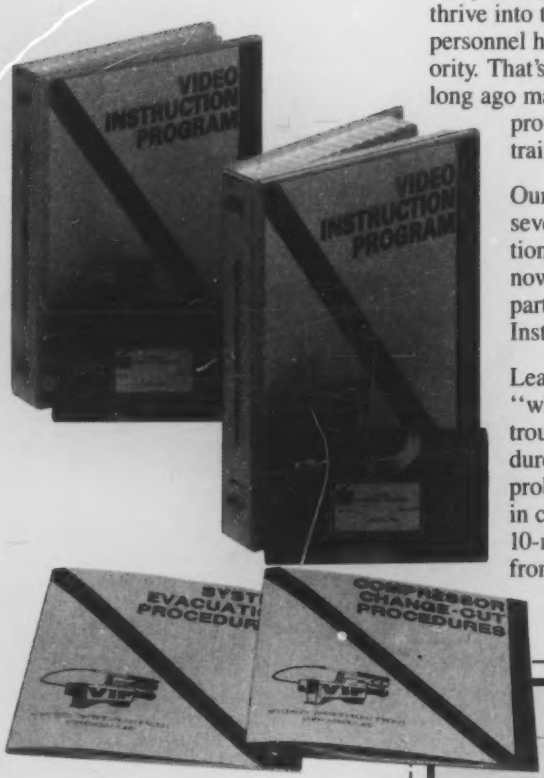

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penetrations into the Northeast's new home market. A much higher percentage of oil furnaces, 86.4%, were replacements. This was backed up with the installation last year of 237,000 replacement oil burners.

We believe 60% of the more than 2 million gas-fired furnaces shipped last year were replacements. In fact, the replacement of gas-fired furnaces in good working order for efficiency reasons probably is leading to additional add-on central air conditioning sales. This is a reversal of roles.

The economy

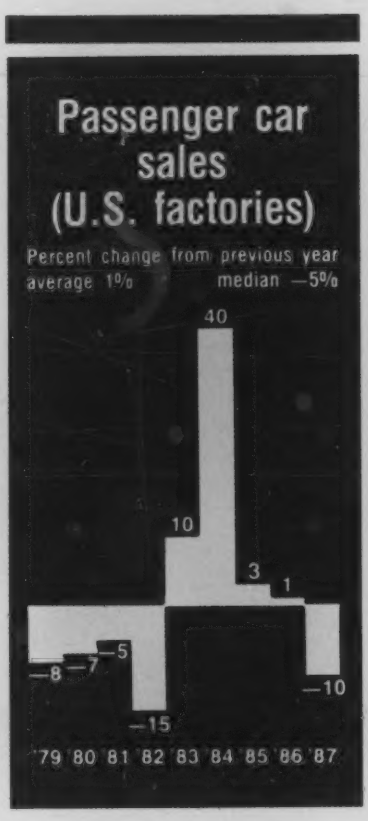
The best thing that can be said for the lackluster performance of the national economy in 1988, the sixth year of expansion since the last recession, is that it could be worse, much worse. Once again there are enough positive factors, just enough, to push the next recession over the horizon.

The gross national product (GNP) grew at only 2.9% last year in real terms and, probably, will struggle to equal that record in 1988. The consumer inflation rate, at 3.7% last year, likely will inch upward in 1988 but not much. Say 4.4%. And unemployment, down to 5.8% nationally late in 1987, probably will increase a bit this year to 6.3%.

It should be remembered, however, that the growth scenario in 1988 still is a misnomer for many. Areas of the nation dependent upon petroleum and agriculture are just beginning to turn the corner after several years of decline. And, although overall industrial production and investment in plant and equipment are up, many spot markets have been hard hit by plant closings.

The good news is that the trade deficit, which stood at about $120 billion last year, is being reduced. The weakened dollar in relation to several major foreign currencies has helped the export of both manufactured goods and agricultural products. But because of the nation's heavy dependence on imports, including oil, the reduction in the balance this year will be only about $20 billion. Remember, too, that the weakened dollar means the U.S. has to pay more for the products it imports.

Interest rates continue to be too high. They are likely to remain high — and even creep upward a bit — largely because of the federal deficit. The nation's investment opportunities must provide an attractive return for foreign investors or the nation will face a critical credit crunch. It's also unlikely that Congress will take meaningful action this election year or next to significantly reduce that wide gap between federal government revenues and expenditures.



Although the falling value of the dollar relative to major world currencies has done little to alter the relationships with Canada, its largest trading partner, there has been a major change relative to major world market competitors Japan and Germany.

Prior to the decline of the dollar which started in 1985, average manufacturing wages in the U.S. were 36% above those in West Germany and 100% above those in Japan. Today, however, average manufacturing wages in the U.S. are 32% below those of Germany and within 5% of Japan. And manufacturing productivity in the U.S., up 3.3% last year, has improved at a 3.5% average annual pace since 1979, the last of six years of productivity losses.

For the air conditioning and refrigeration industries, exports in 1987 increased by 21.4%. But, at the same time, imports — mostly compressors and room air conditioners — increased by 30.1%. The result was a positive net U.S. trade balance of only $323 million, down 4.4% from a year earlier. The trade balance was down 50% from the 1985 level — and a far cry from the $1.5 billion of only a few years ago.

It should be noted that, while the U.S. has become more competitive in world markets with such competitors as Japan and Germany, its own imports from nations not affected by the currency changes continue to grow. It remains to be seen what the proposed free trade agreement with Canada will do to the trade imbalance.

Industrial production in the U.S. stood at 82.1% of capacity at the end of 1987, up from 79.7% a year earlier. Some industries, notably paper, steel, and textiles, are in the mid 90's. In keeping with these figures, investments in plants and equipment are expected to increase by 7% this year.

Meanwhile, consumer confidence appears to be returning after a Christmas lull blamed on events in the stock market. Plans to buy cars, homes, and major appliances were up in February. The air conditioning purchase index was the highest in a year.

Disposable income rose by $59 billion in 1987 and, because the full impact of the so-called tax reform package will take effect this year, should increase even more in 1988. Although installment credit rose 5.9% last year, the increase was much less than the 12.9% rise a year earlier.

There has been a dramatic change in the sensitivity of the new home market to increases in interest rates. The rate for a fixed 30-year mortgage topped 12% last October and has dropped to about 10% in late February. At the same time, the ratio of lower-cost adjustable rate mortgages (ARM's) to the fixed rate variety moved in October to 60%-40% in ARM's favor. ARM's share was only 22% in April, 1987.

Of equal importance to the replacement market is the trend toward home equity loans as a means of financing. In 1987 the number of home equity loans increased by a whopping 75% to $70 billion. The increase this year could be equally dramatic.

AIR CONDITIONING

In the face of a slow-growth economy, a major shock in the stock market, and a 10% loss of new home starts, both unitary air conditioning and its heat pump segment set new performance records in 1987.

The records, which toppled for 18 straight months through last December, came as results of a burgeoning replacement market buoyed by market-building heat waves, steady new single-family home and light commercial markets, and increased inventory levels.

Total shipments of U.S. unitary air conditioners (including air-to-air heat pumps) in 1987 increased by 11.2% for a new record total of 3,955,064 units, according to the Air-Conditioning and Refrigeration Institute (ARI). The 1986 total — the previous record — was 3,555,630 units.

The losses in new home starts were mostly confined to multifamily units, which dropped by almost a quarter in an overbuilt market. The slight drop in heat pump penetration was compensated by the increase of central air conditioning systems used in single-family homes.

There was also an increase in the number of new homes using more than one unitary system. But the big news was in the replacement market. This segment lived up to its billing with a 26% increase in cooling unit shipments to top the million mark for the first time. The smaller heat pump replacement market more than doubled.

Successive heat waves in the Northeast and Midwest during the early summer of 1987, coupled with continuing emphasis on efficiency, should be credited with pushing replacement sales to record levels.

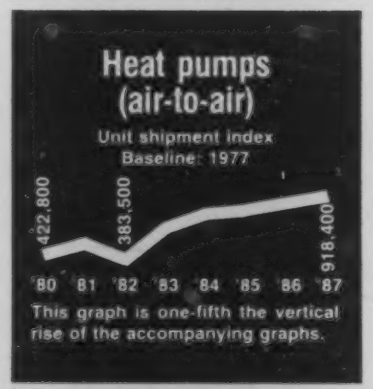
Although there were substantial increases in inventory last year, the unitary record is legitimate. If we remove the increases in inventory from the shipment totals, we find that unitary air conditioning would have enjoyed a record 5.4% gain. Heat pumps, however, would have registered a 1.6% loss.

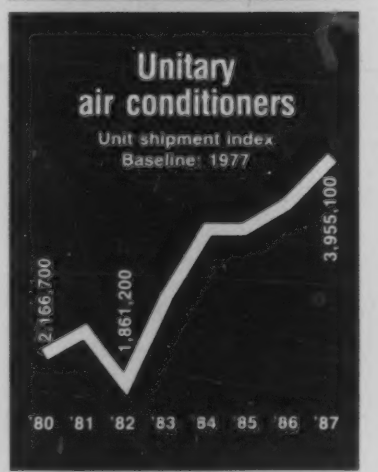
For the fourth year in a row, the industry has posted totals of more than 3 million units. The average has been better than 3.5 million units. There probably won't be any new records this year but totals should be well above the average of the past four years — and a far cry from the 1.86 million units shipped at the depth of the 1982 recession.

These figures do not include air conditioning units and air-to-air heat pumps shipped to foreign markets. Exports of U.S. unitary air conditioners in 1987 totaled 131,174 units, an increase of 69% over the 77,618 units exported in the previous year.

It should be remembered that these export figures include only those units shipped directly to foreign destinations by oem's (original equipment manufacturers) and include few, if any, units shipped by distributors or contractors.

Of the 3,555,630 unitary air conditioners shipped in 1986, ARI reported that 82.4% — or 2,929,839 units — were for residential applications and 17.6% — or 625,791 units — were for commercial applications. The ratio for 1985 was identical.





In recent years the ratio has moved gradually in favor of residential applications and away from the 78%-22% split that held sway for most of the 1970's.

It is, however, in sharp contrast to the ratio posted in 1953, the first year these data were available. At that time, 66.9% of unitary shipments went into commercial applications and only 33.1% went into homes. The residential share passed commercial two year's later and, in 1973, the 78%-22% ratio was achieved.

If we accept that the 1986 split was carried forward into 1987, then 3,258,973 units — or 82.4% of the 3,955,064-unit total — were destined for residential applications and 696,091 units — or 17.6% — were commercial units.

The unitary category includes electric air conditioners, gas air conditioners, air-to-air heat pumps, and rooftop equipment. It does not include packaged terminal air conditioners (ptac's), packaged terminal heat pumps (pthp's), room air conditioners and heat pumps, heat pump water heaters (air-to-water heat pumps), or water-source heat pumps.

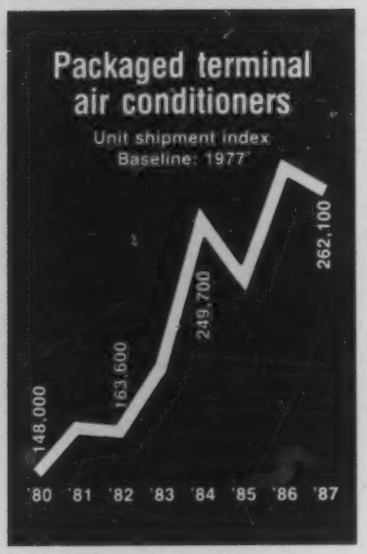
Inventory

The inventory of unitary air conditioners at the end of 1987 totaled 1,178,210 units, up 24.4% from the 947,411 units in inventory at the same time a year earlier. As a percentage of total shipments, the 29.8% at the end of last year was 3% more than at the same time in 1986.

The increase in inventory at the end of 1987 comes on the heels of an 18.4% increase a year earlier but the total still is at the low end of the 30% to 33% range considered normal for much of the industry's history. The ratio sank to 24% of shipments in 1985.

Surveys by The News have confirmed a major improvement in distribution efficiency among both independent wholesaler-distributors and factory branches. Forecasting programs instituted by both major wholesaler groups have had a significant impact. Contractors consistently report only minor equipment availability difficulties.

Of the total inventory at the end of



1987, some 508,662 units — or 43.2% of the total — were at the factory and 669,548 units — or 56.8% — were at the distributor level. This represents a 2% shift toward parity by both segments. However, it is still is a distance from the 49%-51% split in favor of distributors at the end of 1983.

Capacity mix

An indication of capacity mix for 1987 unitary air conditioners and how it compared with 1972 experience follows:

	% 1972	% 1987
Under 1.8 ton	16	10.3
1.8 ton to 26,999 Btuh	23	20.5
2.25 ton to 32,999 Btuh	17	19.1
2.75 ton to 38,999 Btuh	22	22.4
3.25 ton to 43,999 Btuh	6	7.6
3.67 ton to 53,999 Btuh	7	8.4
4.5 ton to 64,999 Btuh	6	7.7
5.4 ton to 96,999 Btuh	1	1.6
8.1 ton and larger	1	2.4

Installed value

The installed value of unitary air conditioning equipment put in place in 1986, the latest year for which these figures are available, was $9,795,592,000, an increase of 7% from the $9,146,303,000 total for 1985, according to ARI's Business Research Department.

Of the total, ARI estimated that the value of commercial unitary installations was $3,392,937,000, or 34.6% of all unitary installations. The total value of residential installations was $6,402,655,000, or 65.4% of all unitary installations.

Even though the commercial sector accounts for only 17.6% of unitary unit shipments, it accounts for 34.6% of installation dollars. Similarly, residential installations account for 82.4% of unit shipments but only 65.4% of unitary system installation dollars.

Installed value covers the cost of unitary air conditioning equipment as shipped from the factory together with labor, ductwork, registers and grilles, thermostatic and other controls, electrical wiring, and other components of the system installed by contractors.

The installed value of field-engineered systems put in place in 1986 was $6,596,414,000, an increase of 1.2% over the previous year's installed value total of $6,515,994,000. The increase from 1984 to 1985 was a whopping 22.9%.

The combination of the two installed value totals in 1986 was $16,392,006,000, an increase of 4.65% over the previous record total of $15,662,297,000. The $16.4 billion total covers all comfort cooling systems, with the exception of room air conditioners, put in place in 1986 in the U.S.

In determining the installed value of field-engineered air conditioning systems, ARI estimates that only 7.5% of the installed cost of the system is represented by the cost of the refrigerating machine. The remaining 92.5% represents air-handling equipment, labor, ducts, pipes, valves, controls, and all other installation costs.

Ptac's

Packaged terminal air conditioners (ptac's) did surprisingly well in a lackluster segment of the market last year. Shipments totaled 262,100 units in 1987, down 3.6% from the total of 271,900 units shipped in the previous year. The number of ptac's shipped has doubled since 1980.

This product is used extensively in hotel-motel, nursing home, and suburban office park applications. These markets, which held up reasonably well last year, are expected to decline by 10% to 15% in 1988.

Ptac's compete head-on with commercial rooftops in the lower tonnage ranges and with field-engineered central systems in office building and hospital applications. Heat pump versions, known as packaged terminal heat pumps (pthp's), captured 45% of the 1987 total, down from 52% a year earlier. The heat pump share was 40% in 1983.

The Bureau of the Census reported that a total of 188,245 ptac's were shipped in 1986, the latest year for which these data are available, down 12.6% from the 215,278 units shipped in the previous year. Of the total shipped in 1986, some 80,569, or 42.8%, were pthp's, down 16.2% from the 96,155 pthp's, or 44.7% of the total, shipped in 1985.

Heat pumps

Although still ranked well behind natural gas, the air-to-air heat pump has become a solid supplier of heat to U.S. homes, particularly where climates are relatively mild in winter. More than a quarter of both new single- and multifamily homes use heat pumps for comfort heating and cooling.

Shipments of air-to-air heat pumps in 1987 totaled a record 918,413 units, an increase of 3.9% over the previous record of 884,203 units achieved in the previous year.

As noted earlier, if the 48,200 heat pumps added to inventory in 1987 were not included, heat pump shipments last year would have declined by 1.6%. Even so, the achievement is remarkable.

Consider, if you will, that it came at a time when multifamily housing starts dropped by 24.5%, when heat pump penetration into new single-family homes slipped a few points, and when both residential and light commercial construction in the South — the heat pump's main market — was spotty at best.

The answer, it would appear, was twofold. First, there was a tremendous surge — 119% by our calculations — in

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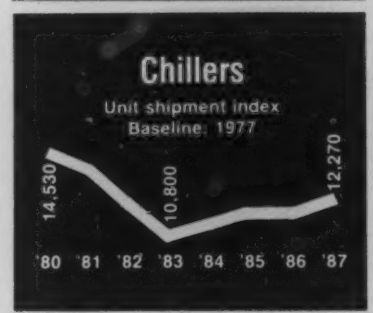

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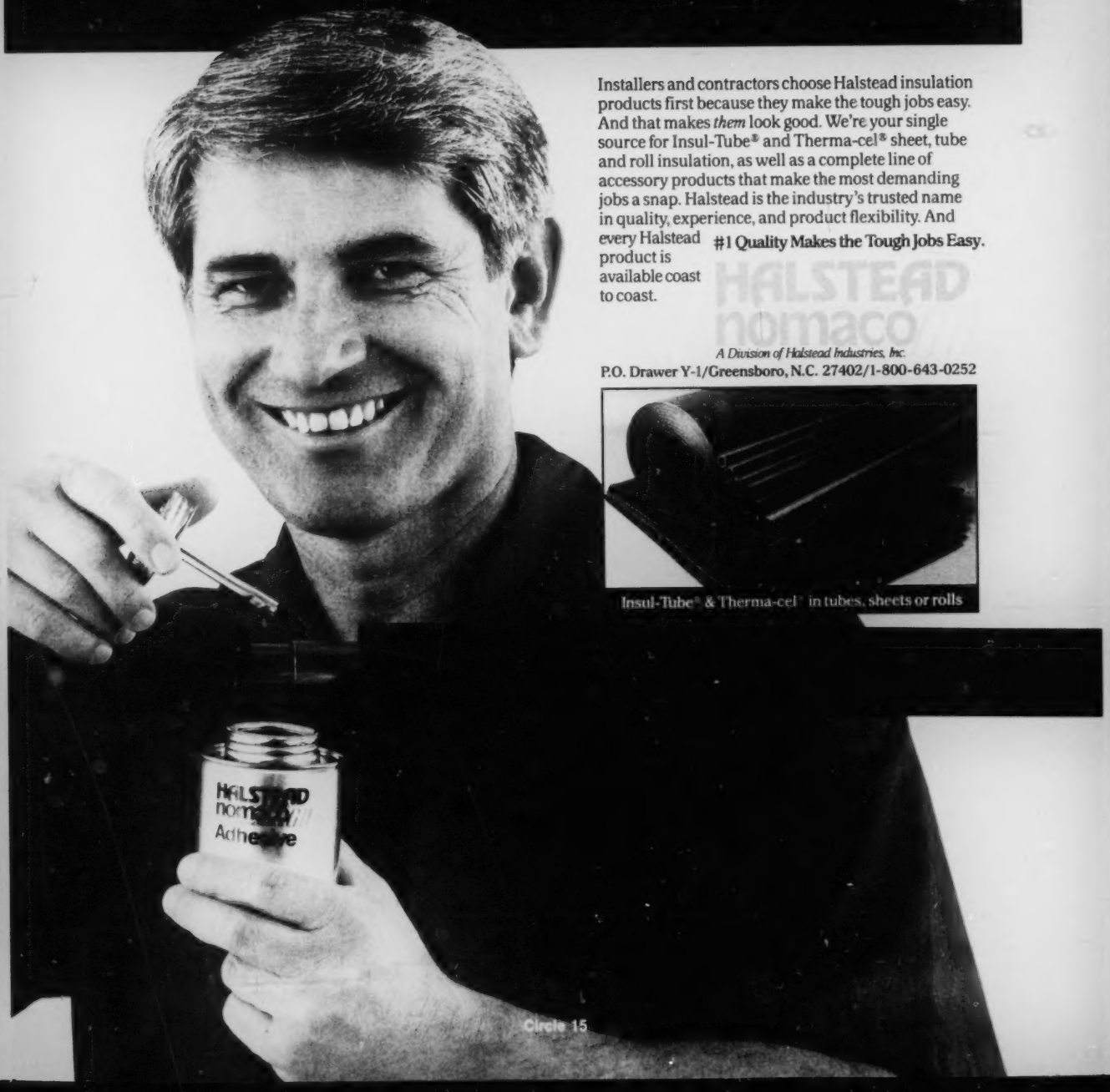

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residential replacements. Most went to replace worn out units bought in the initial years of the heat pump's resurgence. But as many as 20% (by one oem's estimate) went to replace working units for reasons of efficiency.

The second reason, we submit, stems from the fact that penetration figures from the Bureau of the Census don't tell the whole story. In many of the larger custom homes, two or more central systems are installed to achieve both zoning and lower operating costs. Some feel as many as 15% of all single-family homes started today have two or more systems. This, of course, means two or more furnaces, heat pumps, or central air conditioners.

Additionally, a growing number of merchandising contractors in areas where utilities are offering incentives for high-efficiency air conditioners or heat pumps are selling heat pumps as replacements for worn out central air conditioners even though the homeowner has a gas- or oil-fired warm air furnace. The incremental cost, with the rebate, usually is quite small in contrast to the total job and the homeowner saves on fuel bills in the spring and fall.

Looking ahead, we expect heat pump shipments to drop back by 6.4% to about 860,000 units this year. This would be a banner year if any year but 1987 were held up in comparison. The forecast takes into account the anticipated drop in housing starts and light commercial construction but allows for only a 25% increase in replacements. Another increase like last year and heat pumps could set another record.

New home construction in the South and Middle Atlantic states, where heat pump penetration is the highest, is not expected to rebound until 1990. When these markets come out of the doldrums, the heat pump is sure to march alongside.

Meanwhile, in the wings, the gas industry continues its development work on gas-fired heat pump prototypes and a consortium of Japanese companies is continuing work on gas engine-drive heat pump technology. Both U.S. and Japanese companies have introduced inverter-drive units but, so far, they account for only a tiny fraction of the total market.

The air-to-air heat pump figures included in the unitary totals supplied by ARI do not include all heat pumps made in the U.S. To these should be added ptac's in heat pump (reverse cycle) configurations, water-source heat pumps (both earth-coupled and closed loop), air-to-water heat pumps used to heat domestic hot water, and room unit heat pumps.

Water-source units

Shipments of water-source heat pumps, which amounted to only about 40,000 units in the mid-1970's, totaled 138,500 units in 1987, down 5.9% from 147,200 units in the previous year.

These units usually divide naturally to serve two separate markets. The older segment uses closed loops tied to a small boiler and cooling tower or evaporative condenser to maintain a loop water temperature between 60° and 90°F. They take advantage of load diversity and usually are applied in high-rise apartments or condominiums and in small- and medium-sized office buildings.

The other group initially used water from a pond, a well, or the ocean at temperatures as low as 45° and were largely confined to rural or exurban areas. The market has swung over sharply to vertical or horizontal ground loops filled with heat transfer fluid — usually water and alcohol or propylene glycol — to provide comfort heating and cooling at high efficiencies.

Most are water-to-air systems although a few are water-to-water units. They do not have to depend upon the quantity or quality of the ground water. Pumping costs are reduced, defrost cycles are eliminated, and they can be sized for the design heat load so no back-up heat source is required. They also can be applied in urban areas on small lots.

Most, although not all, of these sys-

Our unofficial estimates of unitary market shares

When it comes to figuring the shares of the unitary air conditioning market held by individual manufacturers, we must depend on "feel" rather than reliable numbers. There are no reliable numbers.

Each year, too, the percentages shift as companies enter or leave the market, as one company is acquired by another, or distribution-product promotion improvements are reflected in the marketplace.

In each of the past two years, for example, The News has reported more than 80 mergers, acquisitions, or spinoffs involving almost twice that number of companies directly involved in this industry. What's more, we're not confident that even that list is complete.

It must be remembered, too, that like all national totals our estimates of market share will seldom provide an accurate picture of what is happening in any specific city or area of the country.

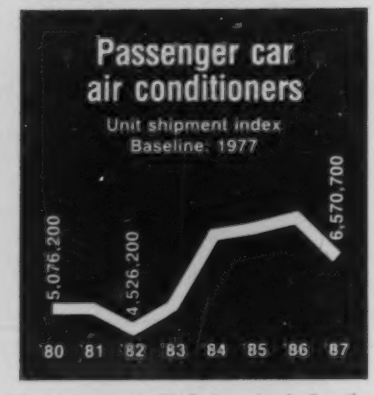
Some of the essentially regional manufacturers, with a small share of the national market, often are among the leaders in the areas where their distribution is concentrated.

Another distortion comes from the interest of the reader. Whether a particular manufacturer is strong in new construction, add-on, or replacement sales makes little difference to many. But for the contractor that specializes, the list of competitive brands can expand or contract according to his interests. It can also change when the contractor's emphasis changes.

Because of these and other situations within their own cities, contractors often get a distorted view of national market shares.

For them, and for market researchers not deeply involved with the air conditioning industry, The News offers these educated guesses of unitary equipment market share in terms of units shipped:

- **Carrier (including Bryant, Day & Night, and Payne) — 23%.**
- **Rheem-Ruud — 15%.**
- **Lennox — 13%.**
- **Trane — 12%.**
- **Central Environmental Systems, York International — 8%.**
- **SnyderGeneral (including Arcoaire and Comfortmaker) — 8%.**
- **Heat Controller — 2%.**
- **Magic Chef (including Johnson, Air Ease, Williams, Armstrong, Gaffers and Sattler) — 2%.**
- **All others — 17%.**



tems are applied in single-family homes. They do, however, have a comparatively high first cost and require specialized application knowledge — factors that are likely to limit these systems to steady, but unspectacular, growth.

Heat pump water heaters

Domestic hot water in U.S. homes traditionally has been heated in gas- and electric resistance-fired storage tanks. A few use oil burners. Desuperheaters help in the South and, in the Northeast and Midwest, some use water jackets on gas- and oil-fired boilers.

Instantaneous hot water heaters of the type popular in Europe and the Far East so far have made little impression on the North American market. Instead, increasing energy prices have motivated homeowners to add extra insulation to storage tanks, add solar assist, and desuperheaters where air conditioners and heat pumps operate for many hours.

The air-to-water heat pump, with an installed cost more than twice that of an electric resistance water heater, entered the market nearly a decade ago with the promise of saving up to 40% in operating costs. Instead of capturing a big chunk of the 7 million annual water heater market, today's heat pump water heater market has been hovering in the 10,000- to 15,000-unit range.

Integrated appliances

Not so for a relatively new product called the integrated appliance. These appliances use a conventional gas-fired domestic hot water storage heater piped to a water coil in a separate air handler. Electric water heaters do not have a recovery rate fast enough for these systems.

The air handler, which can also house a split-system air conditioner's evaporator, uses the domestic hot water tank's hot water for space heating. It saves on overall fuel bills by using much of what had been the hot water heater's storage losses. Special fittings on the hot water tank keep the plumbing and air conditioning technicians from getting involved in each other's trade.

There are no figures for these systems yet but there is no doubt that this market is growing rapidly from a small base. They are being used in both single- and multifamily homes. The market is being helped by gas utilities which, after being almost shut out of the apartment and condominium markets by the trend toward separate metering, are using integrated systems to again become competitive in these markets.

Rooftops

Thanks to a series of heat waves that swept the Midwest and Northeast during the summer of 1987, and a strong replacement market, shipments of commercial rooftop units showed a 6% increase in 1987 despite a marginal drop in new construction.

According to our calculations, rooftop shipments last year totaled 158,200 units, up 6% from the revised total of 149,300 units shipped in 1986.

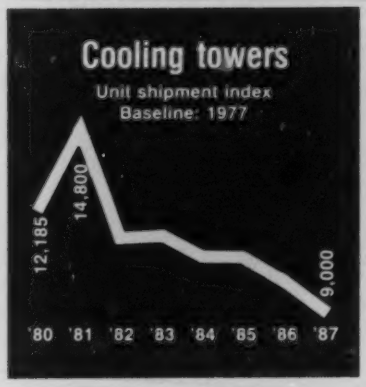
Shopping center and other light commercial and industrial construction tends to follow closely behind the housing market and 1987 was no exception. The downturn in new home starts last year was followed, to a lesser degree, by light commercial contracts.

The dip, only about 2% in real terms in 1987, is likely to be followed in 1988 by a decline in this market segment of 10% to 12%.

Not to be forgotten is the growing importance of the replacement market. Not only are the rooftops of the 1960's and early 1970's inefficient by today's standards, many of them are simply worn out. We estimate that about 45% of the commercial rooftops being shipped today are replacements. In times when the weather turns hot for long periods, such as in 1987 in two major regions, the replacement percentage develops a noticeable spike.

Commercial rooftops really represent a market application of several different products rather than a specific product type that can be identified statistically.

For example, all-year units are identified both by ARI and by the Bureau of the Census and clearly imply a heating capability. However, both single-package and split-system rooftops — although they may have been shipped (and counted) as cooling-only units — may have a modular heating section added in the field.



Too, heat pumps imply one and usually two methods of heating in addition to their cooling capability. Another complicating factor is that small, all-year rooftops are applied in more residential than commercial situations.

The News bases its assessment of the commercial rooftop market on the known number of unitary shipments in 1987 and 1986 of 5.4 tons or more, and by past ARI and Census Bureau ratios of system types and sizes and residential-commercial application.

Although not as up to date as we would like, the exercise does produce a breakdown within a few percentage points of the latest ARI figures that break down shipments by size. We have arbitrarily selected 5.4 tons as the starting point for commercial rooftops even though some may wish to call all commercial units rooftops.

By applying the known — and latest — 1986 ARI ratio to both the 1986 and 1987 ARI unitary shipment figures, we find that there were 673,700 commercial units shipped in 1987, an increase of 11.5% over the 604,300 commercial units shipped in the previous year.

By applying ratios evident in the 1986, and latest, Census Bureau report, we also found that, in 1987:

- 145,600 were split systems, of which 38,000 had capacities in excess of 5 tons.
- 267,000 were all-year single pack-

TURN TO PAGE 24

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ages, of which 69,300 had capacities in excess of 5 tons.

- 121,300 were cooling-only air conditioners, of which 31,700 had capacities in excess of 5 tons.
- 500 were multizones, all of which had capacities in excess of 5 tons.
- 139,300 were air-to-air heat pumps, of which 18,700 had capacities in excess of 5 tons.

Taken together, 158,200 were commercial rooftops with capacities in excess of 5 tons. That 1987 estimate represents an increase of 6% over the revised total of 149,300 commercial rooftops shipped in the previous year.

This leaves 515,500 commercial units with capacities of less than 5 tons that also may be classed as rooftops. We know there are more than 100,000 3-phase commercial units in that smaller-size category. We also know there are residential units in the over-5 ton grouping. We simply don't know how to separate them accurately.

Auto air conditioning

According to Ward's Automotive Reports, there were 6,570,732 air conditioning units installed on U.S. domestic automobiles in the 1987 model year, down 13.1% from the 7,562,508 factory air installations made in the 1986 model year.

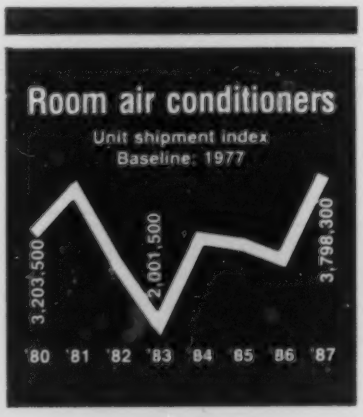
The performance of factory air installations was worse than that of the domestic auto industry as a whole. Production dropped 9.8% from 8,543,732 cars produced in the 1986 model year to 7,707,287 cars produced in the last model year.

The difference was reflected in a drop in factory air penetration rates from 88.5% of all cars produced during the 1986 model year to 85.3% in 1987.

Of cars made in the U.S., almost all luxury and full-size models feature factory air conditioning as standard equipment. And, as can be surmised from the penetration figures, most of the intermediate and compact models also are air conditioned.

Less than half of most subcompact models are equipped with air conditioning at the factory. This is partially because they are the least expensive cars and air conditioning is the most expensive option. Engines also are smaller, an important consideration when subcompacts are equipped with automatic transmissions.

Some have blamed the drop in air conditioning penetration on the competitive new car market. Dealers are ordering floor plans with a higher



proportion of cars stripped of expensive options, they say, so they can advertise lower prices.

It might also be noted that 2,417,696 light trucks produced in the U.S. during the 1987 model year were equipped with factory air conditioning, an increase of 4% over the 2,324,643 factory air conditioned light trucks produced in the previous model year, according to Ward's.

The penetration of factory air conditioning in light trucks has increased steadily from 54.9% in 1983 to 61.3% in 1985 to 67.2% in the last model year.

For the record, a total of 3,596,187 light trucks were produced in the U.S. during the last model year, down 2.7% from the 3,696,865 light trucks produced in the 1986 model year.

The Bureau of the Census reported that, in 1985, a total of 13,008,516 mobile vehicle air conditioners were shipped. Totals for 1986, the latest year for which these data are available, were not provided because of the limited number of manufacturers and the danger of revealing their market shares.

The aftermarket

There are no official figures for the auto air conditioning aftermarket. This market declined steadily from 1978 through 1983 and then climbed back with the domestic auto industry after a wrenching series of shakeouts.

International Mobile Air Conditioning Association (IMACA) executive director Paul M. Allen estimates that the aftermarket has stabilized in recent years at about 750,000 units.

Although the agricultural vehicle market continues soft, other opportunities have opened. The recreational vehicle market has strengthened. And, just as factory air conditioning on light trucks moved from half to two thirds, the medium-duty truck market has blossomed for aftermarket manufacturers.

Those in the aftermarket often supply auto importers with small shares of the U.S. market. Then, as that share grows, they shift to installing air conditioning at the factory. This trend was evident at the recent industry show where double the dozen or so foreign countries were represented. They were mostly looking for components.

The Japanese, with compressors produced at home and in their U.S. plants, supply approximately 80% of aftermarket unit compressors. With the changing value of the yen relative to the U.S. dollar, however, their price advantage has been eroded. In fact, Honda is now exporting compressors built in the U.S. back to Japan.

Within the last couple of years, aftermarket dealers have reported a major surge in service and in service parts. The industry also is watching closely developments leading to an alternative refrigerant. Production of R-12, which has been the refrigerant of choice in auto air conditioning, is likely to be restricted in mid-1989.

Room air conditioners

Thanks in large measure to a succession of heat waves through the Northeast and Midwest last summer, shipments of room air conditioners made in the U.S. in 1987 totaled 3,798,300 units, an increase of 34.9% over the 2,815,700-unit total for the previous year, according to the Association of Home Appliance Manufacturers (AHAM).

But that's not the whole story. Also in the first 11 months of 1987, room air conditioner imports into the U.S. totaled 678,575 units, up 80.5% over the 375,879 room units imported into the U.S. for the whole of 1986.

Room unit imports have grown rapidly. In 1984, for example, the U.S. imported only 141,731 room units. And while the changing value of the yen to the U.S. dollar reduced imports from Japan to only 10% of the total last year, other major suppliers have sprung up in Brazil, Korea, Singapore, and Malaysia. It should be noted also that a major U.S. supplier, Carrier Corp., moved its room unit production to Brazil.

If we add U.S. production and imports together, then, we see that 1987

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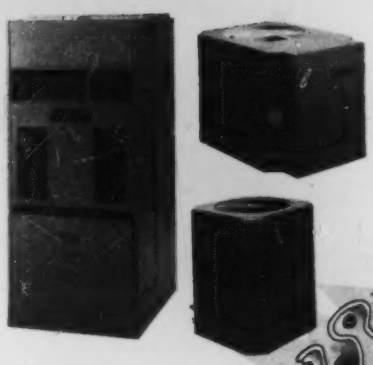
Because the rugged British weather can play havoc with comfort, York comfort-conditioned a magnificent 16th-century castle located near York, England, with high-efficiency York heating and cooling equipment. And we are going to tell the world about it. In newspaper ads, billboard, on radio and even television.



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The York Royal Treatment Sweepstakes could make you a big winner.

Another way we're helping you increase sales! Participating York distributors will give away free trips for two to London, England. It's part of the Royal Treatment Sweepstakes and all homeowners are eligible. Winners will stay at the 5-star Royal Garden Hotel, via British Airways.

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was a great year for room units and approached the 5 million unit plateau that characterized several years in the previous decade. The total in 1987, at more than 4.477 million units, was up at least 40% over the total domestic room unit market the previous year.

The weakened value of the dollar also appears to have had a beneficial effect on room unit exports, which once routinely accounted for a quarter of U.S. production. Exports through the first 11 months of 1987 totaled 105,858 units, up 64.9% over the 64,207-unit total for the whole of 1986. Exports, however, still account for less than 3% of U.S. room unit production.

Room units continue to be largely an impulse purchase sparked by hot weather. They are marketed principally by appliance and department stores. Only about 5% of room units are marketed by contractors and wholesalers.

AHAM expects room unit shipments in 1988 will total 3,230,000 units, down 15% from last year's performance. The variables, for good and ill, include another hot summer and increased imports from abroad.

For the record, the Bureau of the Census reported that 2,685,552 room air conditioners were shipped in 1986, the latest year for which these data are available. This represents a 0.7% increase over the 2,665,825 room units the Bureau said were shipped in 1986.

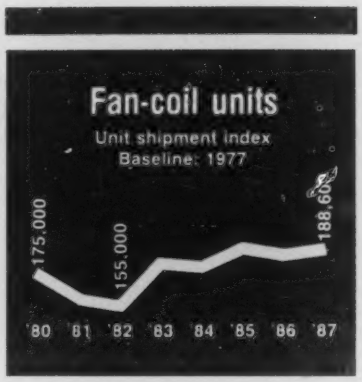
Chillers

Even though the office building market declined last year, the chiller market managed a modest amount of growth. Total chiller shipments in 1987 amounted to 12,270 units, up 4.7% from the total of 11,720 units in the previous year.

The 3,700 centrifugal chillers shipped in 1987 were essentially even with the 3,730 units shipped in 1986. It should be noted that the 1986 and 1987 totals do not include open-type centrifugals. In the past, we have speculated that open centrifugals account for 400 to 500 units.

Reciprocating chillers shipped in 1987 totaled 8,440 units. This represents an increase of 7.7% over the 7,840 reciprocating chillers shipped in the previous year. Shipments of absorption chillers, at 130 units last year, were down 18.7% from the 160 absorption chillers shipped in the previous year.

The market for chillers, an essential ingredient in field-erected air conditioning systems, has been hampered by an overbuilt office building market that has declined for the past two years and promises a continued downturn in 1988. Too, the hard dollar in the first half of the decade made it tough competing in foreign markets and manufacturers began making much of the 50 Hz equipment abroad.



The lower value of the dollar in many world markets has not yet had a significant effect on U.S. chiller production. The domestic institutional new construction market has continued strong, however, and replacement chiller sales have been capturing an increasing market share.

The number of chillers shipped also has been influenced by a growing trend to use more units in a single installation in order to achieve better capacity control and overall operating economy.

For the record, the Bureau of the Census reported that 13,302 reciprocating chillers were shipped in 1986, the latest year for which these data are available. This represents a 5.4% decline from the revised total of 14,064 reciprocating chillers shipped in 1985.

The Bureau reported that 3,903 centrifugal chillers were shipped in 1986, down 3% from the 4,025 centrifugals the Bureau reported were shipped in the previous year. These totals do not include open-type units, nor do they include centrifugals 200 hp and under or from 401 to 500 hp.

In 1985, the Bureau said 131 absorption chillers were shipped. In 1986, however, it lumped them into another absorption category so they would not reveal the market shares of individual manufacturers.

At year's end in 1987, U.S. dollar bookings for reciprocating liquid chillers were down 2%. Similarly, dollar bookings for large tonnage liquid chillers were up 7% from the same period a year earlier.

Year	Recip.	Cent.	Abs
1970	10,300	4,150	1,000
1971	10,000	4,000	900
1972	10,000	3,000	900
1973	10,400	4,100	800
1974	11,000	4,500	1,000
1975	8,250	4,950	700
1976	7,600	3,400	500
1977	8,900	3,000	450
1978	8,100	3,350	370
1979	8,100	3,350	280
1980	9,650	4,600	280
1981	9,250	4,300	240
1982	8,500	3,600	200
1983	7,500	3,100	140
1984	8,100	2,950	160
1985	8,160	3,490	130
1986	7,800	3,700	160
1987	8,440	3,700	130

Evaporative condensers

Shipments of evaporative condensers for 1986, the latest year for which these data are available, totaled 2,282 units, according to the Bureau of the Census. This represents an 8.8% decline from the 2,505-unit total reported for the previous year. Of the total, 41% were under 100 tons and 59% had capacities of 100 tons or more.

Fan-coil units

Shipments of fan-coil units to U.S. markets in 1987 totaled 188,600 units, an increase of 1.3% over the total of 186,170 units shipped in 1986.

Bureau of the Census figures, which include exports, show that 205,731 fan-coil units were shipped in 1986, the latest year for which these data are available. This represents an 11% increase over the 185,263-unit total for 1985. Of those units shipped in 1986, some 9% were vertical stack units, 46.8% were vertical units, and 44.2% were horizontal units.

Cooling towers

The only figures available for cooling towers are those collected by the Bureau of the Census. In 1986, the latest year for which these data are available, the Bureau reported 9,579 cooling towers were shipped. This represents a 13.4% decline from the 11,063 cooling towers the Bureau said were shipped in 1985.

REFRIGERATION

Unit shipments of commercial refrigeration equipment were essentially flat in 1987, according to the Commercial Refrigerator Manufacturers Association (CRMA). The total improved by 1.4% over the previous year's performance.

The trade association does not report numerical totals for either shipments or for the various equipment categories.

Based on the percentages supplied by CRMA, plus data published in prior years by the Air-Conditioning and Refrigeration Institute (ARI) and the Bureau of the Census, The News estimates that shipments in 1986 totaled 107,300 units. The 1.4% increase in 1987 would bring the new total to 108,800 units.

CRMA reported that shipments of standard-temperature cases in 1987 increased by 0.5% over shipments in the same category a year earlier. These cases represent about 60% of the total, or 65,125 units in 1987.

Of the standard-temperature cases, shipments of reach-ins last year were down 0.1%, island units increased by 5.2%, and "other" units increased by 2%, according to CRMA. The News estimates that, in 1987, shipments included 55,100 reach-ins, 6,250 island units, and 3,775 other units.

CRMA no longer provides figures on walk-in coolers.

Shipments of low-temperature cases in 1987 increased by 2.8% over shipments in this category during the previous year, according to CRMA.

For the same period, the trade association reported that low-temperature single-deck case shipments were down 5.1%, multidecks were down 9.7%, island units were down 9.9%, but enclosed (glass door) display units were up 17.5%. Of the enclosed units, 2-door units were up 2.1%, 3-door units were up 24.4%, 4-door units were down 3.8%, and 5-door units were up 25.1%.

Again, The News estimates that, in 1987, a total of 2,140 low-temperature single-deck units were shipped. Similarly, we estimate that another 4,760 were multidecks, 14,150 were island units, and 22,625 were enclosed (glass door) display units.

Other views

Because these figures are not as solid as we would like, we think it would be helpful to repeat some past — and

dated — information from other sources.

According to the Census Bureau, the manufacture of commercial refrigeration equipment in 1982 totaled $1,070,800,000, an increase of 41% over the $759.4 million total for 1977.

The Census Bureau reported that 67,900 sectional coolers, prefabricated walk-in and roll-in coolers, and combination cooler-display units were shipped in 1982. There was not a comparable shipment total for 1977 but the dollar value increased by 40.8% from $158.6 million in 1977 to $223.3 million five years later.

Standard-temperature reach-ins shipped in 1982 totaled 128,500 units, up 73.6% from the 74,000-unit total shipped in 1977. The dollar value increased by 108.8% from $68.2 million in 1977 to $142.4 million in 1982.

The Bureau reported standard-temperature closed cases shipped in 1982 totaled 16,000 units, up 42.9% from the 11,200 units shipped in 1977. Open single-level cases were down 5% from 26,000 in 1977 to 24,700 units in 1982. Open multilevels were almost even. The total was 31,700 in 1977 and 31,300 five years later.

Low-temperature reach-ins shipped in 1982 totaled 43,500 units, up 45.5% from the 29,900 units shipped in 1977. Ice cream dispensing-hardening cabinet shipments totaled 13,700 units in 1982, up 11.4% from the 12,300-unit total in 1977.

Open single-level frozen food display cabinets shipped in 1982 totaled 13,200 units, down 59% from the 32,200 units shipped in 1977. Open frozen food multilevel cases shipped in 1982 totaled 11,800 units, up 7.3% from the 11,000 units shipped in 1977. Closed frozen food cabinets, other than reach-ins, totaled 14,800 units in 1982, up 131.3% from the 6,400 units shipped five years earlier.

We must emphasize that these Bureau of the Census figures include equipment that finds its way into convenience stores, restaurants, and commercial-industrial catering operations as well as supermarkets. Too, the Bureau estimated that some of the quantities represent estimates with an error factor as high as 29%.

A private study published by Specialists in Business Information, Inc., Wantagh, N.Y., provides estimates of shipment value and some information on unit shipments. It, too, also covers such related areas as water and dairy coolers and restaurant equipment.

SBI estimates that the market for reach-in refrigerators and vertical display cabinets totaled $420 million in 1986. The market for other display cases and cabinets totaled $477 million in that year and walk-in, roll-in, and combination coolers was estimated at $361.2 million.

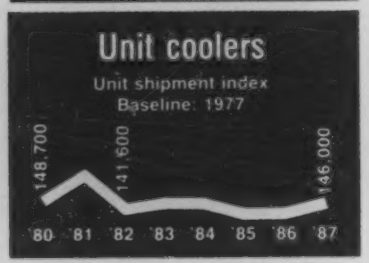
In the period 1982 through 1986, SBI estimated that unit shipments of vertical display cases have increased by 54.5%, other display cases have increased by 42.2%, and walk-in cooler shipments have increased by 41.8%.

In 1986, SBI estimated that standard-temperature display case unit shipments totaled 100,100 units and that low-temperature display case unit shipments totaled 79,500 units. Of the standard-temperature cases, 23,800 were closed units, 32,700 were open single-level units, and 43,600 were open multilevel cases.

Of the low-temperature cases, SBI estimates were shipped in 1986, a total of 17,600 were open single-level units, 15,700 were open multilevel units, 25,600 were closed (solid or glass doors) units, 1,000 were ice cream counter freezers, and 19,600 were ice cream dispensing and hardening cabinets.

In the 62-page report, researchers speculate that commercial refrigeration shipments, on a current dollar basis, will increase at an 8.4% annual average compound rate and reach $3.87 billion by 1996. Unit sales are expected to increase by about 5% annually.

In 1986 the nation's 30,500 supermarkets did $219.5 billion in sales, up 4.6% over the previous year, according



to Progressive Grocer magazine. Of the total number, about 44% are independently owned and 56% are owned by chains.

In a survey of the top 50 chain operations, the executives overwhelmingly supported a conservative approach in 1988. They said expansion and renovation plans will remain at 1987 levels — or just over 10% of the total. However, they added that superstores (which already account for more than half of new construction) and combination stores (another one in five) will be emphasized.

Even though the amount of disposable income spent for food prepared in the home is at an all-time low, supermarkets accounted for 72% of the $305 billion in sales by all grocery stores in 1986, according to Progressive Grocer. And because today's customers spend much less time in the kitchen, supermarkets have changed their offerings.

For example, delicatessen sales in 1986 totaled $5.2 billion, or 2.35% of all supermarket sales. Six of 10 stores have a service deli, another 27% have self-service delis offering salads and entree items, and 44% offer hot takeout dishes. Sandwich meats still account for 40% of deli sales.

Supermarkets are expanding in-store bakery operations now that improved frozen dough has eliminated the need to do everything from scratch. Frozen food sales in 1986, at $13.9 billion or 6.3% of total sales, held even. Because the more expensive entree preparations already have made their impact, larger dollar increases in this area are not expected in the immediate future.

Of the other major users of refrigeration, the $37 billion in meat sales (16.9% of total sales) were up 2.6% in 1986. Dairy sales accounted for $20.7 billion, or 9.4% of the total, and produce accounted for $19.5 billion, or 8.7% of the total.

Although the pace of new construction has not been spectacular in recent years, the changes within the stores have been substantial. These include fancier delis, expanded bakeries, salad, soup, and make-your-own-meal bars. There are also many partially prepared meat and fish dishes ready for the home oven.

Instead of supplying only the raw materials for the home kitchen, supermarkets increasingly are becoming extensions of that home kitchen. There is a marked consumer preference for bigger and bigger stores. And, in new stores and remodels, European-style cases have become more and more popular.

The nation's 46,000 convenience stores are just beginning to pay closer attention to energy usage. Industry reports indicate that economizers on rooftop cooling equipment are becoming popular with chain operators.

And, because a typical 12-door walk-in cooler consumes about a quarter of the store's total energy, more attention is being given to heat recovery and such energy-saving devices as floating head pressure controls.

On the restaurant scene, the National Restaurant Association forecasts that sales in restaurants, bars, contract, and institutional feeders will increase by 7.1% in 1988. The real increase, after inflation, would be 2.9%.

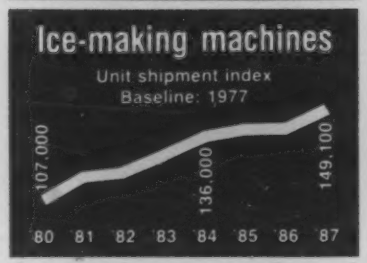
The fast food industry is expected to grow by 8.5% (4.3% real growth) in 1988 to $60 billion. Mid- and up-scale restaurant sales are expected to increase by 2.5% in real terms to $70.6 billion. Similarly, contract feeding will increase by 2.9% to $11.5 billion, food service in commercial office buildings will be up 4.8%, and industrial accounts will be up 1.4%. Feeding in schools and colleges will be down somewhat.

Refrigerators

Home refrigerator shipments totaled 6,972,100 units in 1987, an increase of 7.1% over the 6,510,400 domestic refrigerators shipped in the previous year, according to the Association of Home Appliance Manufacturers (AHAM).

The slight drop in new home starts this year, together with a steady replacement market, will mean a modest 3.5% decline in 1988 shipments of home refrigerators to 6,730,000 units, according to AHAM.

Shipments of home freezers in 1987 totaled 1,259,700 units, an increase of 3.1% from the 1,222,200-unit total for the previous year. The 1987 breakdown shows 692,200, or 55%, were



chest-type freezers, up 4.7%, and 567,500 units, or 45% of the total, were upright freezers, up 1.1% from the year-previous total.

Manufacturers are looking for a 3.5% decline in home freezer shipments in 1988 to 1,217,000 units.

Unit coolers

Shipments of unit coolers, at 146,000 units in 1987, demonstrated an increase of 5% from the prior year total of 139,000 units.

It should be noted that the Bureau of the Census reported that 186,357 unit coolers were shipped in 1986, the latest year for which these data are available. This represents a 9.2% decrease from the 205,282 unit coolers the Bureau said were shipped in 1985.

The industry figures do not include exports or the production of several significant manufacturers.

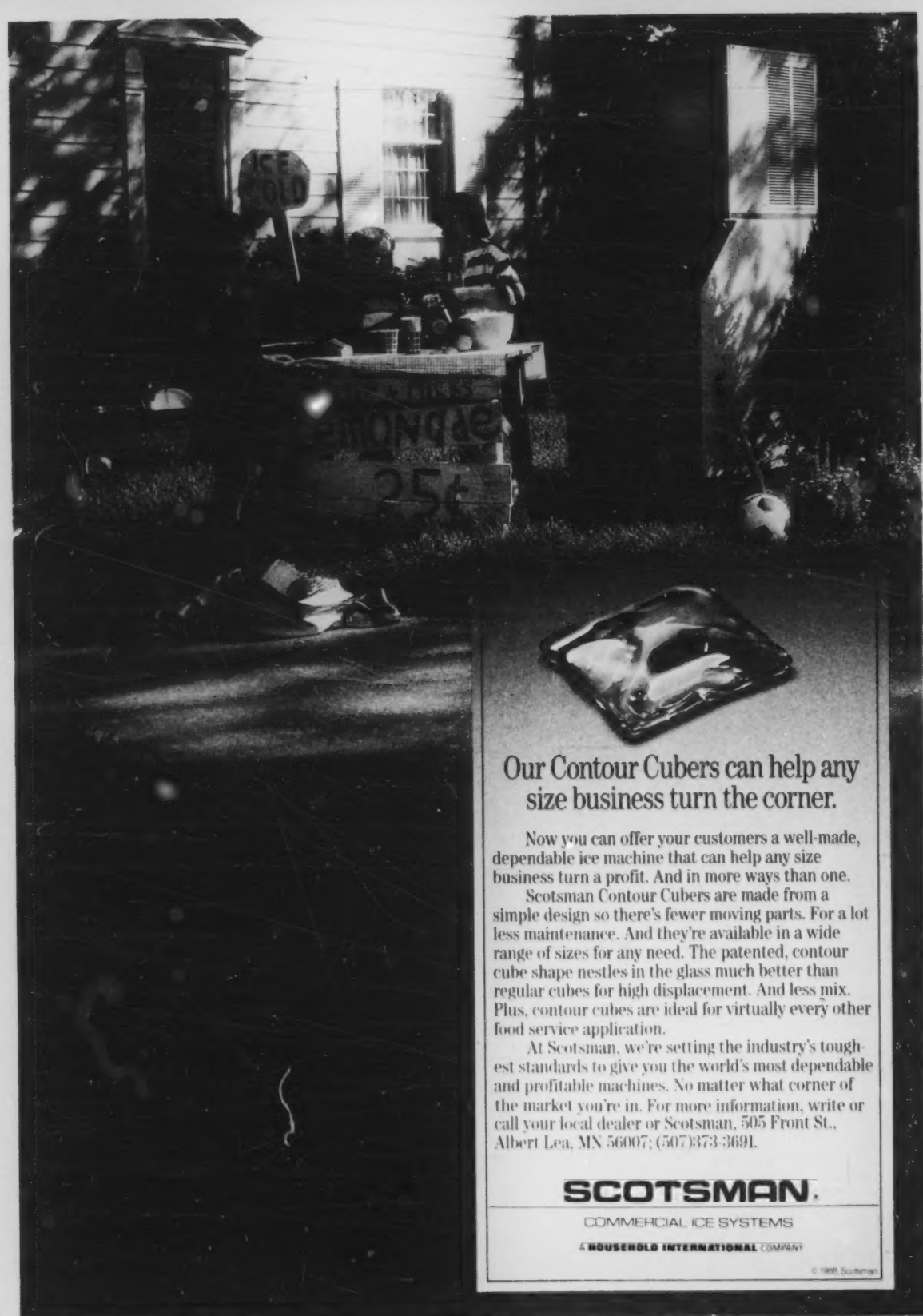
Ice-makers

If we stick to the format of past Statistical Panoramas, shipments of ice-making equipment in 1987 totaled 149,120 units, up 2.7% from the total of 145,260 units shipped in the previous year. Of these, The News believes 83% were cubers and 17% were flakers.

A year ago we added ice maker-dispenser combinations, a move that added 86,700 units to the 1985 total, 88,300 units to the 1986 total, and 90,880 units to last year's total. The revised total for 1987, then, would be 240,000 units, an increase of 2.8% over the 233,500 units shipped in 1986.

The Bureau of the Census reported that 202,446 ice-making machines were shipped in 1986, the latest year for which these data are available. This represents a 0.4% increase over the 201,668 ice makers the Bureau said were shipped in the previous year.

It's apparent that a major discrepancy still exists between government and industry figures. Both sets include domestic and export shipments.



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HEATING

Unit shipments of gas- and oil-fired boilers in 1987, at 356,466 units, showed a 7% increase over the 332,932 cast iron and steel boilers shipped a year earlier, according to The Hydronics Institute (HI).

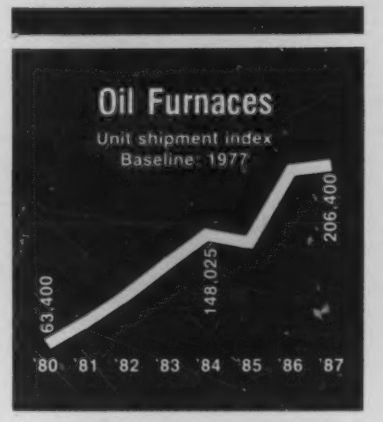
Although a strong new home market in the Northeast could be credited with the 10.1% increase in boiler shipments in 1986, the following 7% rise last year came at a time when new home starts in this bastion of hydronics experienced a modest decline.

The reason, according to HI's general manager John Kaussner, is the success of industry promotion activities and increasing consumer awareness. In addition, the hydronics industry enjoys a high percentage of replacement sales — a market that is being helped by the extremely high cost of homes in many Northeast communities.

Shipments of **cast iron boilers**, at 314,758 units in 1987, increased by 8.9% over the year-previous total of 289,010 units. Shipments of **steel boilers**, however, were down 5.3% from 43,922 units in 1986 to 41,708 units last year.

Although gas-fired boilers continue to dominate the market, it wasn't always so. Gas curtailments in the 1970's restricted the growth of gas-fired units and, at the turn of the decade, the sudden availability of natural gas led to a surge of demand for gas units.

The surge was relatively short-lived and, by the mid-1980's, the relationship between gas- and oil-fired units returned close to historical ratios. Lower oil prices in the last couple of years, as



we shall see, have led to some modest gains for that fuel against gas.

The gas share of the cast iron boiler market, which peaked at 85% in 1980, settled to a more normal 59.8% in 1987, down from 61.5% a year earlier and from 66.9% in 1984. It dropped to 50% in 1977, the last year of widespread gas curtailments.

Oil's share of the cast iron boiler market in 1987 was 40.2%, up from 38.5% in the previous year and 33.1% in 1984. Oil held only a 15% share in 1980, a year which also witnessed many conversions from oil to gas. The oil share only a few years earlier, in 1977, was 49.5%.

The share of cast iron hot water boilers, at 81.6% in 1987, was almost identical to the 81.3% experience in the previous year. Conversely, cast iron steam boilers in 1987 accounted for 18.4% of shipments, down a hair from the 18.7% share in 1986.

In the case of steel boilers, however, oil continues to dominate. The 35,942 oil-fired steel boilers shipped last year accounted for 86.2% of the total, down from 88.4% in the previous year. The 693 gas-fired steel boilers accounted for only 1.7% of the total shipped in 1987, down a hair from a 1.7% share a year earlier. The 5,073 bare (without burners) steel boilers shipped in 1987 accounted for the remaining 12.1% share, up from 9.8% in 1986.

Radiation shipments in 1987, according to HI, were:

Convectors — 1,776,982 sq ft EDR (equivalent direct radiation), up 5.9% from the 1,678,219 sq ft EDR total in 1986.

Baseboard — 16,352,889 lineal feet, up 8.6% from the 15,059,904 lineal feet total in 1986.

Commercial finned tube — 6,796,633 sq ft EDR, up 3.1% from the 6,593,709 sq ft EDR total in 1986. Expressed in lineal feet, the 1987 total of 1,340,496 lineal feet was up 3.4% from the 1986 total of 1,297,046 lineal feet.

Total shipments of radiation products are far below those of only a few years ago because of the high ratio of boiler replacements where radiation already is in place. Replacements account for about 85% of the residential boiler market. Gains in new single-family home construction in recent years, however, have produced corresponding gains in baseboard radiation shipments.

Looking ahead, hydronics cannot expect too much help from the new home market in 1988. Housing starts in the Northeast are in for a modest decline. The replacement market should continue strong, however, especially in those areas where inflated housing costs are keeping many out of the new and existing home markets.

And, as noted by HI, both manufacturers and contractors are having significant success with local promotions. Many manufacturers, too, no longer see air conditioning as a competitor and have taken on compatible comfort cooling lines so contractors no longer lose sales to their air-system competitors.

Residential furnaces

An exceptionally strong replacement market must be given credit for the

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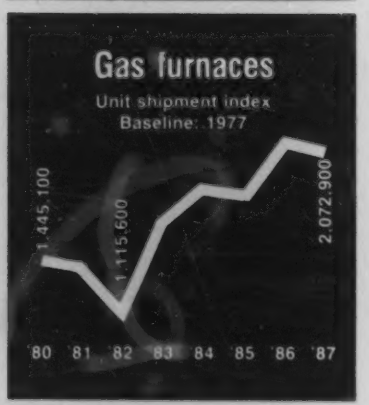

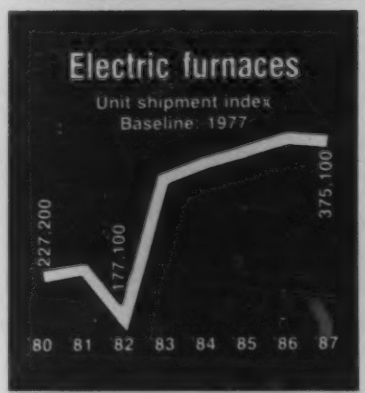

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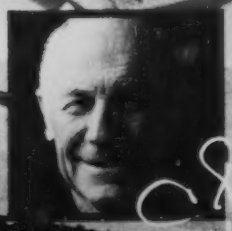

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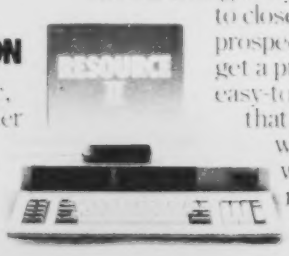

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2.9% increase in **oil-fired furnace shipments** in 1987. Shipments increased from 200,540 units in 1986 to 206,445 units last year, according to the Gas Appliance Manufacturers Association (GAMA).

Replacements, however, are only part of the story. Oil furnace shipments have risen dramatically from 103,500 in 1982 to 148,000 in 1984 and more than 200,000 in each of the past two years. Major drivers have been the surge of new home construction in oil heat's bastion, the Northeast, and increased penetration by oil as a fuel.

New home construction in the Northeast peaked in 1986 and fell off a bit last year. The decline is expected to continue until at least 1990 but the drop is not likely to be precipitous. Price and land availability have become major problems in this area.

It should be noted that 80% of the nation's oil-fired home heating systems are located in the Northeast and that almost nine of 10 of those systems were installed prior to 1964. Market upheavals of the 1970's and early 1980's, which caused many to convert to other fuels, appear to be over for the foreseeable future.

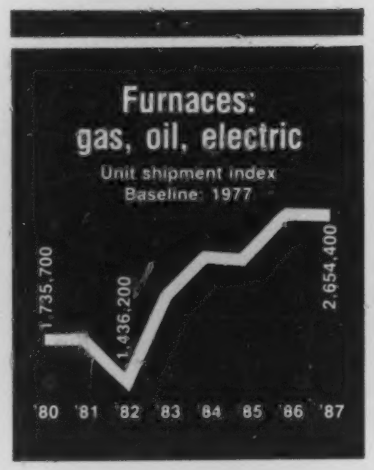
In November, 1987, GAMA's members forecast that oil furnace shipments would decline by 4.6% this year to 197,000 units. We tend to agree. However, the replacement market strength could keep this market segment even.

As an aside, the Bureau of the Census reported 172,038 oil furnaces were shipped in 1986, the latest year for which these figures are available. This represents an 18.6% increase over the revised 1985 total of 145,048 oil furnaces.

Here and elsewhere in this issue we will report Bureau of the Census figures when they are available even though they often vary considerably from industry figures. We favor the industry figures because they are more up to date and, in our experience, more accurate.

Despite a 10.5% drop in new home starts last year, **shipments of gas furnaces** almost held their own on a high plateau. The 1987 total, at 2,072,925 units, was only 1.5% less than the 2,104,805 units shipped in the previous year.

These two years above the 2 million mark were well above the previous record of 1.86 million units set in 1979 and considerably above the 1.15 million units shipped during 1982 at the bottom of the last recession.



New home construction, particularly the single-family unit, is important to gas furnace marketers. Penetration rates currently are close to half of new single-family homes and about a third of new multifamily units. It was significant, then, that single-family home starts were down only 3% last year. A 24% drop was experienced by the smaller multifamily segment.

GAMA's members feel gas furnace shipments in 1988 will hold even at 2,015,300 units. Given the expectation that new single-family starts will hold about even this year, and that the already substantial replacement market should more than make up any multifamily market losses, we expect gas furnace shipments this year to increase by 5% to about 2.18 million units.

For the record, the Bureau of the Census reported that 1,846,384 gas-fired furnaces were shipped in 1986, the latest year for which these data are available. This represents a 1.6% increase over the revised total of 1,816,676 gas furnaces the bureau said were shipped in 1985. The Census Bureau also noted that 1,897 gas-fired gravity warm air furnaces were shipped in 1986, down 31.4% from the 2,765 gravity units shipped in the previous year.

Gas-fired unit heater shipments held steady again last year. GAMA reported that total unit heater shipments in 1987 amounted to 164,040 units, down 0.5% from the revised total of 164,863 units in 1986.

Of the total, shipments of propeller-type unit heaters in 1987 totaled 153,085 units, down 0.3% from the 153,531 units shipped the previous year. Shipments of blower-type unit heaters, which represent only 6.7% of the total, amounted to 10,955 units last year, down 3.3% from the 11,332 units shipped in 1986.

GAMA's members expect unit heater shipments in 1988 will increase by 3% to 169,100 units. Given the small increase in industrial construction expected this year, their assumption appears valid.

It should be noted that the Census Bureau reported that, in 1986, a total of 324,238 gas-fired unit heaters were shipped, up 12.8% from the 287,531 unit heaters shipped in the previous year. Obviously the government figures include the outputs of manufacturers who do not participate in the in-

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1987 cast iron boiler shipments by thermal capacity

Gross output, Btu/h	Steam	Water	Total
Less than 50,000	826	9,729	10,555
50,000 to 74,999	1,412	26,949	28,361
75,000 to 99,999	8,236	51,702	59,938
100,000 to 124,999	16,596	77,170	93,766
125,000 to 149,999	5,134	23,732	28,866
150,000 to 199,999	11,379	43,616	54,995
200,000 to 249,999	5,064	12,234	17,298
250,000 to 449,999	4,192	7,164	11,356
450,000 to 949,999	2,501	2,330	4,831
950,000 to 1,549,999	1,289	997	2,286
1,550,000 and over	1,449	1,057	2,506
Totals	**58,078**	**256,680**	**314,758**

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dustry program.

Gas-fired duct furnace shipments dropped by 7.4% in 1987 to 18,629 units, according to GAMA. The 1986 total was 20,108 units. The trade association's members expect shipments will increase by 5% this year.

Gas-fired residential wall furnace shipments in 1987 totaled 166,540 units, down 15.4% from the 196,930 wall furnaces shipped in the previous year, according to GAMA. The manufacturer members expect shipments to bounce back this year by 14% to 190,100 units.

The total includes vented wall furnaces, which dropped 17.3% from 127,920 units in 1986 to 105,740 units last year, and direct-vent wall furnaces, which were down 11.9% from 69,010 units in 1986 to 60,800 units last year. GAMA reported the direct-vent total does not include total industry shipments.

The Census Bureau reported 249,893 gas-fired wall furnaces were shipped in 1986, the latest year for which these figures are available. The total represents a 21.6% decline from the 318,618 units shipped in 1985.

Shipments of **recreational vehicle heating systems** in 1987 totaled 234,771 units, up 12.8% over the previous year's total of 208,043 units, according to GAMA. This market segment has not been expanded to include the total industry.

Shipments of **gas-fired floor furnaces** totaled 19,704 units in 1987, down 7.4% from the 20,108-unit total for the previous year. This category, too, has not been expanded by GAMA to include the total industry.

The Census Bureau reported that 24,330 gas-fired floor furnaces were shipped in 1986, the latest year for which these data are available. That's a 2.7% decline from the total of 24,996 units shipped in 1985.

GAMA reported that a total of 267,669 **gas-fired room heaters** were shipped in 1987, down 5.1% from the year-previous total of 281,411 units. Of these, 90,564, or one-third, were vented room heaters in 1987, down 2.1% from the 1986 total of 92,475 units. Also in 1987, unvented gas room heater shipments totaled 177,105 units, down 5.1% from the 1986 total of 188,936 units.

Some perspective

Even though it's covered in more detail in "Comfort and construction," we should point out that the volatility of fuel prices that has been a characteristic of the furnace and boiler markets for nearly two decades is continuing.

When the second major escalation in world oil prices impacted the U.S. in 1978, along with the sudden availability of natural gas after almost a decade of curtailments, there was a wave of conversions to gas from oil and electricity. The decontrol of oil prices in 1981 only added fuel to the fire.

The wave of conversions subsided in the early 1980's, a victim of the recession and a rising tide of gas price increases — as much as 50% a year — in the wake of increases in the controlled price of interstate gas.

Early in 1983, however, the price of industrial gas edged past the Btu-equivalent price of residual fuel oil. Industrial and utility users, who almost always can fire boilers with at least two fuels, began switching from gas to heavy oil. And because the gas industry sold more than half of its output to this class of user, the ceiling had been reached.

When oil prices in late 1985 and early 1986 dropped to $12/barrel and lower, the gas industry was in trouble. Even when oil prices stabilized somewhat at $3/barrel higher, gas utilities still had a tough time keeping large customers. Many who did not want to switch to oil began making deals with producers and pipeline companies to buy direct, a practice that has been only slightly dampened by new regulations governing producer debt write-offs.

Gas supplies appear to be more than adequate for the near term. AGA is confident the industry will work its way out of the oversupply "bubble" by the early 1990's and that adequate supplies will be available after that. The pending Canada-U.S. free trade agreement will make more Canadian gas available to U.S. users, AGA adds.

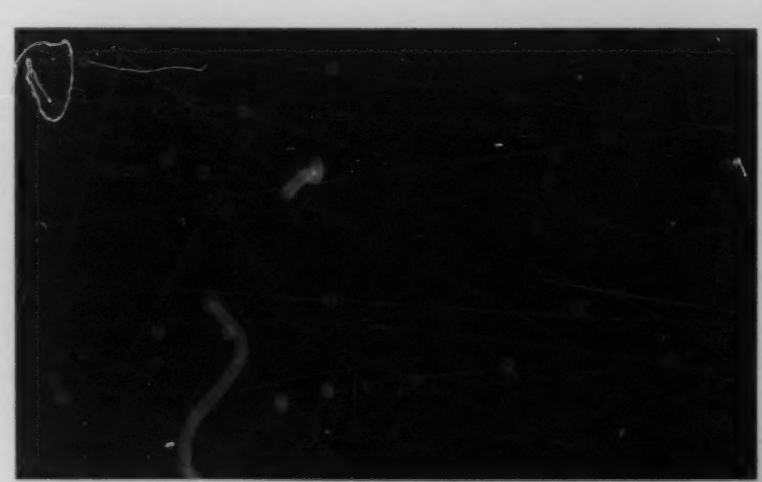
Other factors limiting natural gas growth include limitations of the distribution system in the South, which still accounts for about half of new home starts, and major improvements in home heating equipment efficiencies.

In 1987, for example, a third of the more than 2-million gas furnaces shipped had AFUE's (annual fuel utilization efficiencies) of 80% or more. And, of these, half had AFUE's in excess of 86%. This is in sharp contrast to efficiencies in the 60% range for most gas furnaces installed since World War II.

On the oil front, 55% of the 206,445 oil furnaces shipped last year had AFUE's of 80% or more. Only 5% of shipments had efficiencies of less than 75%. As for electricity, utilities are continuing to offer incentives for high-efficiency heat pumps and air conditioners in order to postpone expensive new generating capacity.

These developments, while important, are mostly local in nature and do not lend themselves to a national summary.

Electric furnace shipments, which tend to closely follow new home construction, lived up to that label in 1987. Shipments of electric furnaces totaled 375,055 units last year, down 2% from the 382,590-unit total for 1986. This is also a reflection of the reduced



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demand in the South's new home market.

Looking ahead, GAMA expects electric furnace shipments to hold even in 1988. Although home market recovery in the South is still at least a year away, any decline in this market segment should be modest.

The primary role of the electric furnace has been to serve as a back-up heat source for air-to-air heat pumps and as the sole heat source for homes in relatively mild climates. Unlike its gas- and oil-fired cousins, electric warm air furnaces enjoy a small replacement market.

Total **gas, oil, and electric furnace shipments** in 1987 amounted to 2,654,425 units, down 1.25% from the total of 2,687,935 units shipped in the previous year. The 1986 total eclipsed the previous record of 2,658,000 set in 1972 when housing starts were in their heyday.

Given the relative stability of the new single-family home market nationally and a still-strong replacement market, the outlook for 1988 is excellent. Don't look for much of an increase. Any decrease should be no more than 1% or 2%. It will be a flat market of near record proportions.

In addition to the furnaces already covered, the Bureau of the Census reported that **forced air furnaces fired by solid fuels** (coal, coke, and wood) shipped in 1986, the latest year for which these data are available, totaled 4,293 units, down 8.4% from the 4,624-unit total for the previous year.

Shipments of **mechanical coal stokers** shipped in 1986 totaled 1,889 units, down 1.2% from the 1,911 units shipped in 1985.

Similarly, the Census Bureau reported shipments of **electric unit heaters** in 1986 totaled 100,987, down 6.6% from the 108,111 unit heaters shipped in the previous year. **Electric infrared heater** unit shipments in 1986 amounted to 16,480, down 3.8% from the 1985 total of 17,124 units.

Shipments of **electric duct furnaces** in 1985 totaled 156,793 units. In 1986 this product was combined with electric furnaces.

Shipments of **electric baseboard**, except glass panel types, in 1986 totaled 2,253,717 units, down 4.6% from the year-previous total of 2,363,328 units. Shipments of **electric space heaters**, other than baseboard, in 1986 totaled 1,087,441 units, down 16.2% from the 1,297,017 units shipped in 1985.

Oil burners

Oil burner installations in 1987 totaled 578,000 units, up 4.1% over the 555,000 installations made in 1986, according to Fuel Oil/Oil Heat magazine.

Of these, 54,000 were installed in new single-family homes, down 43.2% from the 95,000 oil-fired systems installed in new homes in 1986. New home installations totaled 85,000 in 1979.

The increase in oil burner installations came almost wholly from oil marketing's strength in the Northeast. But after two strong years in a row, the housing market in that area has begun to falter. The decline has been caused more by high prices and a scarcity of serviced land than by a lack of demand.

Meanwhile, oil heat has enjoyed a resurgence built on considerably lower prices for fuel oil and continued escalation of natural gas and electricity in many areas.

There were 237,000 **replacement oil burners** shipped in 1987, an increase of 10.8% over the 214,000 replacement burners shipped in the previous year.

The magazine estimates that nearly all of these burners were retention-head or other high-efficiency types that were used to replace less efficient burners on a voluntary (simply to save fuel) or involuntary (breakdown) basis. In fact, it has become increasingly difficult to find old burner designs.

Fuel Oil/Oil Heat estimates that 180,000 oil-fired furnaces were shipped in 1987 — the identical number that were shipped in 1986.

Conversions to oil from other fuels in 1987 were estimated at 39,000, an increase of 11.4% over the 35,000 conversions the magazine estimated were made in the previous year. Only 9,000 conversions were made in 1984.

Most of these conversions were from electricity although, in regions where natural gas is expensive, a few have converted to oil. Conversions from oil to natural gas, which approached 300,000 in 1980, were not significant in 1987.

The Bureau of the Census reported that 28,116 **commercial and industrial oil burner units** were shipped in 1986, the latest year for which these data are available. That represents a 30.3% increase over the revised total of 21,587 units shipped in the previous year.

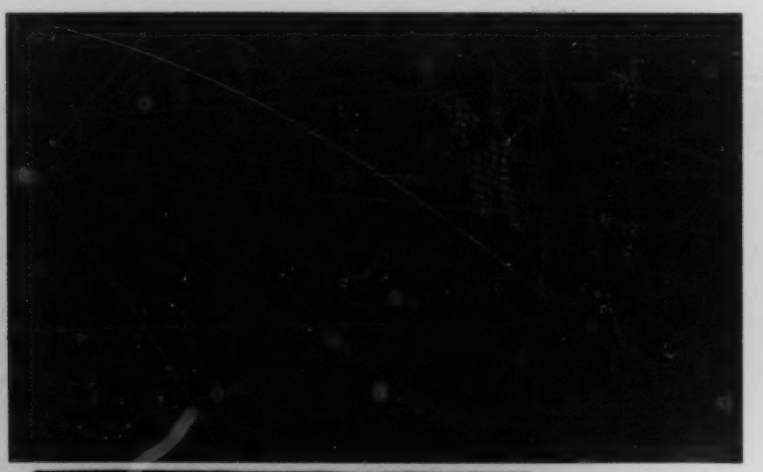
Replacement oil burners for commercial and industrial applications in 1986 totaled 22,130 units, up 2.5% from the 1985 total of 21,587 replacement burners. There was no breakdown for low- and high-pressure atomizing types. In past years they have been almost evenly split.

The Census Bureau reported that shipments of **oil-fired floor and wall furnaces** in 1986 totaled 4,868 units, up 20.2% from the total of 4,050 floor and wall furnaces shipped in the previous year.

The Bureau also reported that, in 1986, a total of 512,822 **residential replacement oil burners** were shipped, up 14.8% from the year-previous total of 446,740 units.

Commercial boilers

The American Boiler Manufacturers Association (ABMA) forecast that the



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commercial boiler market in 1988 will increase by about 3.5% to 21,327 million pounds of steam per hour.

The order rate in 1987 was 20,600 million pounds of steam per hour, down 8.4% from the previous year's total of 22,500 million pounds of steam per hour.

The 1988 forecast for industrial units, at 21 million pounds of steam per hour, is 18.6% below the 1987 total of 25.8 million pounds of steam per hour. The 1986 total was 18 million pounds.

The cogeneration market continues to be volatile. The 1987 total of 2,303 MW (megawatts) exceeded the industry forecast by 279%. In 1988, however, ABMA, expects a steep 68.4% drop to 728 MW.

The Burner Group forecasts that burner shipments in 1988 will be the same as for 1987 at 16,320 units. Stoker shipments should increase by 12% from 41 units in 1987 to 46 units this year.

For the record, the utility boiler market continues its rapid expansion. Total orders for utility boilers in 1987, at 2,836 MW, showed a 54.2% increase over the previous year's total of 1,836 MW. ABMA expects a 55.3% increase in 1988 to 4,403 MW.

Other heating equipment

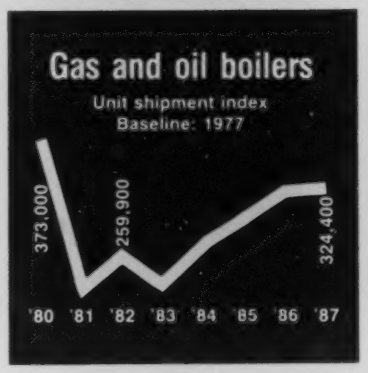
The Wood Heating Alliance (WHA) reported that, in 1986, a total of 567,500 wood stoves were shipped. This represents a decline of 4% from the 590,900 wood stoves shipped in the previous year. The figures are based on a study for WHA which was conducted by LSI Systems, Inc.

Of the wood stove total, WHA estimated that 56,100, or 11% of the total, went into new homes and 511,400, or 89% of all wood stoves shipped, went into existing homes. The ratio was the same in 1985.

WHA estimates that, in 1986, a total of 1,517,000 fireplaces were installed, an increase of 1.8% over the 1,489,900 fireplaces installed in 1985. Of these, a total of 1,118,900 fireplaces, or 73.8% of the total, went into new homes and 398,100 fireplaces, or 26.2% of the total, were installed in existing homes.

Shipments of fireplace inserts, at 566,700 in 1986, were up 17% from the 484,100 inserts shipped in the previous year, according to WHA.

It should be remembered that the Environmental Protection Agency (EPA) now requires that all wood stoves manufactured after July, 1988, be certified as to emissions. In 1990 retail establishments will not be allowed to sell wood stoves that are not certified.



Additional perspective on the total comfort space heating market is provided by the Bureau of the Census. The bureau reported that for 1986, the latest year for which these data are available, a total of 1,076,552 **domestic heating stoves** were shipped, up 5.6% from the total of 1,019,054 domestic heating stoves shipped the previous year.

Of these:

- 163,877 were gas-fired, down 6.1%, from the 1985 total of 174,561 gas-fired stoves. This category includes radiant units as well as vented and unvented circulating types.
- 323,774 stoves used other fuels, up 50.6% from the total of 215,021 stoves of this type shipped in 1985. The other fuels include kerosene, gasoline, fuel oil, and coal.
- The total for the broad classification of wood stoves, at 588,901 units in 1986, was down 6.5% from the 629,472 wood stoves shipped in the previous year.

Of this total, 52,145 were freestanding fireplaces, down 21% from the 65,997 freestanding units shipped in 1985; 345,942 were zero clearance fireplaces, up 16.5% from the total of 296,879 units shipped in 1985; 71,412 were fireplace inserts, down 29% from the 100,563 inserts shipped in 1985; and 119,402 were wood stoves, down 28.1% from the 166,033 units shipped in 1985.

Of the wood stoves, 46,317 were circulating types in 1986, down 35.3% from the 71,601 units shipped in 1985; 37,556 were radiant type, down 15% from 44,162 radiant units shipped in 1985; and 35,529 were other types, down 29.3% from the 50,270-unit total for this category in 1985.

Solar

The Bureau of the Census reported that shipments of solar collectors in 1985, the latest year for which these figures are available, totaled 58,687 units, down 53.3% from the revised total of 125,560 units shipped in 1985.

Of the total shipped in 1986, low-temperature collectors designed to operate below 110°F accounted for 84%, or 49,243 units – down only 3.6% from the year-previous total of 51,090 units. This category also includes an unstated number of high-temperature (operating range above 180°) concentrating and evacuated-tube collectors.

A total of 9,444 medium-temperature collectors were shipped in 1986, down 87.3% from the 74,470-unit total shipped in the previous year. Medium-temperature units operate at temperatures in the range 110° through 180°.

Of the medium-temperature units shipped in 1985, a total of 11,977 – or 16% – were air units and 62,493 – or 84% – were liquid units. No breakdown was provided for 1986 shipments.

Relatedly, photovoltaic (pv) module production in the U.S. and abroad appears to be on the brink of large scale production and significant price declines.

Announcements by U.S. companies promise the construction of manufacturing facilities with a production capability of 22 MW (megawatts), almost doubling the 1986 world pv production total of 28 MW. They predict 30% to 50% annual growth rates in the U.S. and faster growth abroad. They also talk about pv installations costing $2.50/watt within the next year.

Meanwhile, the solar collector market struggles on, a shadow of its former self. The record:

1978	170,611	
1979	226,659	up 33%
1980	303,102	up 34%
1981	254,768	down 16%
1982	201,217	down 21%
1983	175,080	down 13%
1984	170,942	down 2%
1985	139,411	down 19%
1986	58,687	down 53%

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Circle 20

Minneapolis is key market for power humidifier sales

Most of the approximately one-half million power humidifiers shipped every year are installed in homes in the Northern tier of states: Illinois, Michigan, Wisconsin, Ohio. No state absorbs more humidifiers than Minnesota, which has the ideal climate for this product: a long winter and a dry one.

The greater Minneapolis-St. Paul area has more than 800,000 homes, of which about 300,000 are prime candidates. They are single-family units with forced-air gas furnaces.

Virtually all of the area's hvac contractors sell humidifiers to this market. Among them is Tom Sedgwick, of Sedgwick Heating and Air Conditioning, who sells about 300 humidifiers a year. He gets a lot of his business from the new housing market.

"Like every other heating contractor, we put a sticker on the return air drops of furnaces we install in new homes," he says. "We also know the floor plan of the house, having done a lot of repetitious work for builders. We know if there is a floor drain or if the electrician has dropped in enough low-voltage wiring so we can put the humidistat right by the thermostat in the living space. These are things our salesmen are aware of. So we're often able to sell the humidifier over the phone without having to make a sales call."

Sedgwick concedes he should be working harder to tap the old house market. "But we're shifting our emphasis more into the existing house market. The margins are certainly better on old houses, and your money turns faster.

Sedgwick doesn't see much of a replacement market for humidifiers. "Credit the manufacturer for that," he says. "The units just don't seem to break down. They just go on and on and on.

"There's really not much that can go wrong with a humidifier. There aren't many moving parts, and you just have to replace the filter media on schedule. We just haven't run into a replacement market here, and I've been selling them since they were called Chippewas."

Tom Chouinard of Dependable Heating and Air Conditioning agrees that Twin Cities homeowners are sold on the benefits of humidification. He estimates that as many as half the homes in the Minneapolis market have some type of humidification — either power or portable.

The market was softened up 20 years ago by humidifier manufacturers and by mass merchandisers like Sears and Montgomery Ward, he says. "They did an outstanding job of educating people about how to resolve the problems of static electricity, dry noses and throats, and furniture cracking," he says.

In the new house market, there is often a slight lag between the time a new house is occupied and the owners' need for humidification, Chouinard believes. "The first year isn't bad," he says. "There is a lot of moisture in the new home's building products — carpets, wood, walls — but the second year, the owner is very much aware that there is something wrong." Then the phone starts to ring.

He finds that relatively few new homes come equipped with humidifiers. "Tract homebuilders are looking for the low buck, and getting the potential buyer is always a problem. The more (appliances) you put into a home, the harder it is to find qualified buyers. So they put in the basics and let the buyer add the other things, like humidifiers, later."

Like Sedgwick, Chouinard thinks the replacement market is minimal. The best opportunity comes at furnace replacement time. "Our sales people examine the furnace, and if they see a bad humidifier, we'll suggest a new one. But very few people call and request a humidifier replacement."

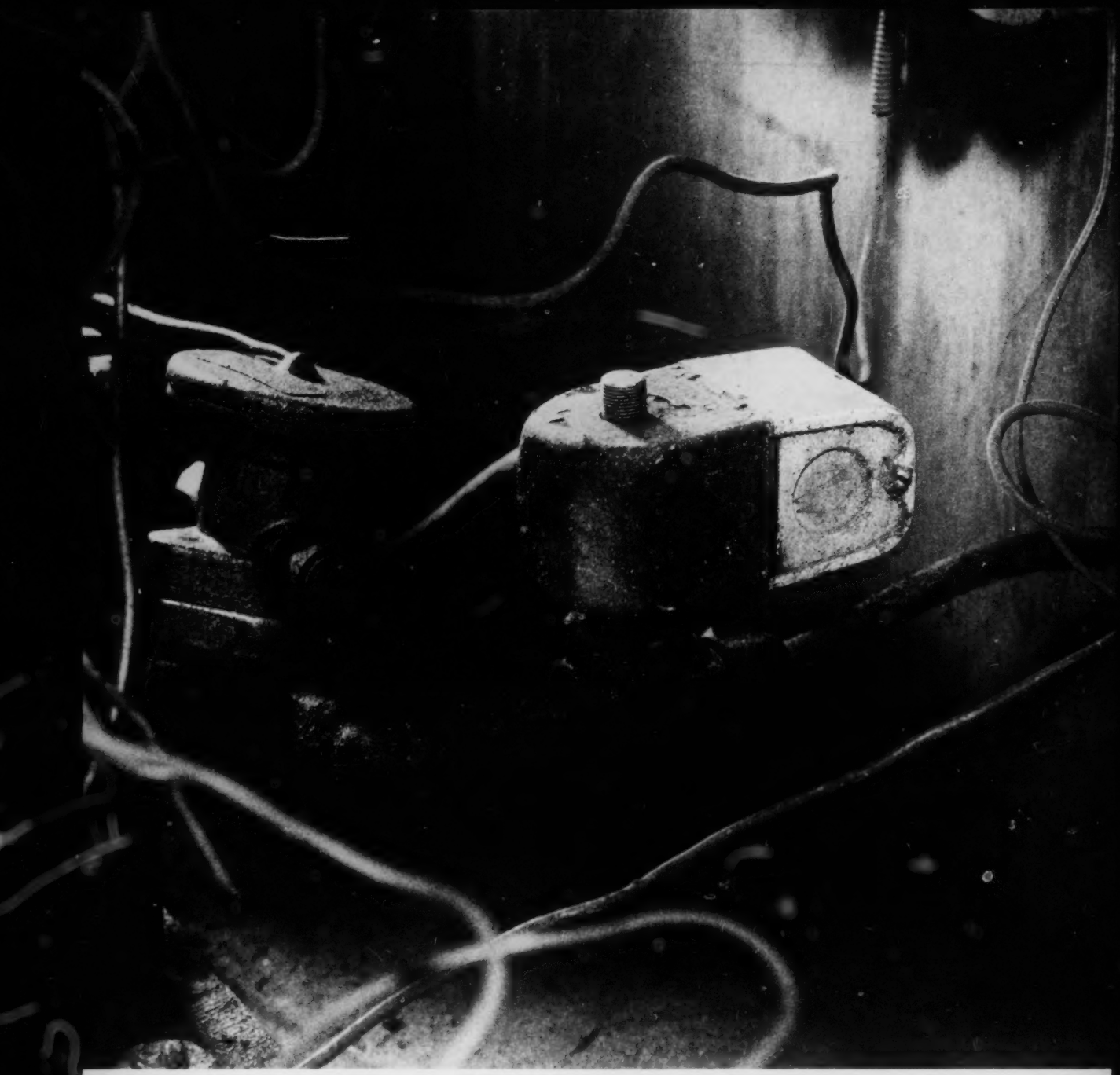
A third contractor, Ted A. Ferrara, of Standard Heating and Air Conditioning, focuses on the old house market. He wants no part of new construction. He thinks today's humidifiers are far superior to those made 20 years ago. This means that units going into homes today will mean a far smaller replacement market in the future.

Humidifiers pass the "headache" threshold. Ferrara won't stock or install any product that gives him a headache. "The margins aren't high enough on humidifiers to warrant service calls or service contracts," he says. "There really isn't anything to service on them. We teach our customers how to replace the filter media when we sell them.

"I have one in my own house, and believe me, I wouldn't have one if it required constant service."

MINNEAPOLIS CONTRACTOR Ted A. Ferrara targets the old house market for humidifier sales. He avoids tract housing and the builder market.

"The margins aren't high enough on humidifiers to warrant service calls or service contracts."
— Ted A. Ferrara, Minneapolis.



Installation date: January, 1968 and hasn't needed servicing yet.

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Circle 2

RELATED PRODUCTS

Sales bookings for industrial air pollution control equipment, which peaked at just over $1 billion in 1979, have spiraled downward over the intervening years. There was a slight upturn in 1986 but, last year, there was another decline, according to the Industrial Gas Cleaning Institute (IGCI).

Total bookings in 1987 amounted to $231.7 million, down 16.4% from the revised total of $277.3 million in the previous year. The total for 1985, the bottom on the spiral, was $153 million.

Flue gas desulphurization equipment bookings, at $94.9 million in 1987, were down 14.4% from the $112.5 million total in 1986. For perspective, this volatile market peaked in 1979 at $404 million. As late as 1983, bookings totaled $191.7 million and, in 1985, sank to $8.9 million.

Another precipitous drop was experienced by gaseous emission controls. Bookings in 1987 totaled only $8.2 million, down 64.5% from the $23.1 million total for the previous year. It should be noted that bookings in 1985 totaled $4.8 million.

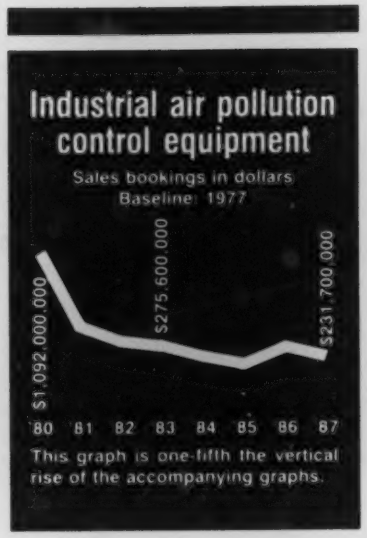
The booking value for electrostatic precipitators in 1987, at $73.9 million, increased by 19.4% over the revised 1986 total of $61.9 million. This market has held reasonably steady in recent years.

Fabric filter bookings, at $42.9 million last year, were down 36.6% from the revised total of $67.7 million in 1986. The 1985 total was $80 million.

Mechanical collector booking values, at $2.5 million in 1987, were down 44.4% from the revised total of $4.5 million in the previous year.

Wet scrubber bookings, at $9.3 million last year, were up 22.4% from the revised 1986 total of $7.6 million. The 1984 total was $17 million, according to IGCI.

The institute's statistics cover new orders for installation in the U.S. and Canada. All orders include bare flange-to-flange hardware with the exception of flue gas desulphurization equipment, which includes the total contract value.


Industrial air pollution control equipment
Sales bookings in dollars
Baseline: 1977
$1,092,000,000
$275,600,000
$231,700,000
80 81 82 83 84 85 86 87
This graph is one-fifth the vertical rise of the accompanying graphs.

Power humidifiers

Thanks to a stronger housing market in the Midwest and Northeast, and more reasonable interest rates, power humidifier shipments have climbed close to the levels enjoyed through much of the 1970's.

We feel that power humidifier shipments last year totaled 480,000 units, up 13% from a revised total of 425,000 units in 1986. Looking ahead, we feel that a 500,000-unit year is possible in 1988 even though new and existing home sales in key markets will be down a bit.

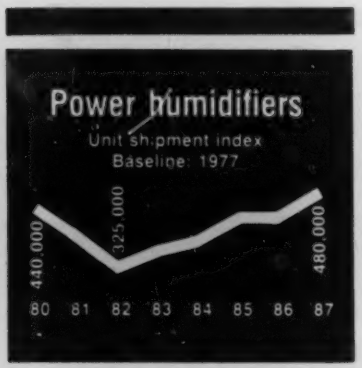
About 90% of power humidifiers are installed in existing homes and only about 10% go into new homes. However, they often are installed soon after a new or existing home is purchased by people who, for reasons of health or comfort, feel they want the benefits of humidification.

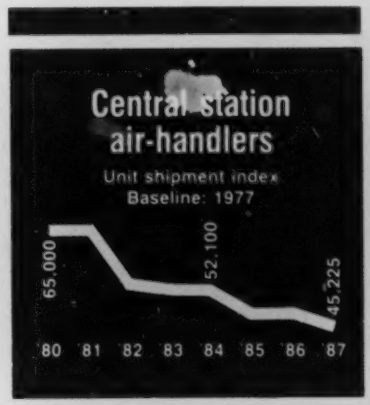
Although housing starts dropped a bit last year and will drop again this year, single-family starts should hold almost even. Starts in the Midwest, home of 55% of the nation's power humidifiers, and the Northeast, where another 25% are located, should remain relatively strong. According to the Energy Information Administration's 1984 housing characteristics study, 28.5% of Midwest and 15.2% of Northeast homes have power humidifiers.

The surge in 1988 is most likely to come as an indirect result of the burgeoning replacement market. This market for both heating and cooling systems is building dramatically. There are an ever-increasing number of merchandising contractors, too, who include accessories such as power humidifiers in their quote.

A fear that the power humidifier market would be limited by the growing number of tightly insulated homes has never materialized. Because of the low infiltration rates in these homes, ventilation units and dehumidifiers often are used to reduce indoor humidity that builds as a result of household activities. So far the number of super-insulated homes built in the U.S. has not significantly affected the humidifier market.

For the record, the Bureau of the Census reported that a total of 422,385 humidifiers were shipped in 1986, the latest year for which these data are available. This represents an increase of 14% over the 370,585 humidifiers the Bureau said were shipped in the previous year.





RELATED PRODUCTS

Fans

All three categories of the Air Movement and Control Association's (AMCA's) Air Movement Division reported increases in 1987.

Shipments of centrifugal fans last year totaled $124,676,000, an increase of 4.8% over the 1986 total of $119,013,321. The 1987 shipments were just a hair higher than the $124,554,256 total for 1985.

Industrial axial and propeller fan shipments in 1987 totaled $64,955,000. This represented an increase of 4.7% over the previous-year total of $62,061,091.

The total value of power roof ventilator shipments last year was $83,687,000, up 0.6% from the total of $83,227,289 record in 1986.

In the Air Control Division, shipments of louvers, dampers, and shutters in 1987 totaled $59,366,000, down 5.5% from the 1986 total of $62,807,777.

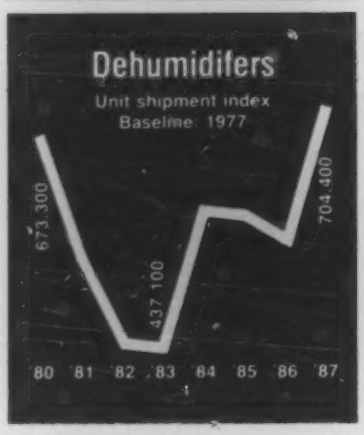
AMCA in 1978 eliminated reports on fans shipped to the power generation market and placed them in another category which is not made public. The Air Movement Division figures are based on reports from more than 60 manufacturers while those of the Air Control Division represent input from 22 companies.

Central-station air handlers

Shipments of central-station air handlers in 1987 totaled 45,225 units, down 6% from the 48,113 units shipped in the previous year. Expectations are that the decline will continue in 1988 at about the same pace.

For the record, the Bureau of the Census reported that 61,364 central-station air handlers were shipped in 1986, the latest year for which these data are available. That represents a 4% increase over the 59,008 units the Bureau said were shipped in 1985.

Of those central-station air handlers the Bureau said were shipped in 1986, draw-through units constituted 78.8%, blow-though 11.4%, and heating and ventilating types amounted to 9.8% of the total.



Electronic air cleaners

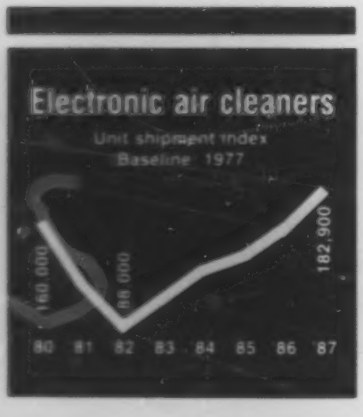
Relatively strong new and existing home markets, coupled with surging heating and cooling equipment replacement sales, helped electronic air cleaners (eac's) to yet another increase in 1987.

According to our estimates, shipments of electronic air cleaners totaled 182,900 units in 1987, up 18% over the previous year's total of 155,000 units.

Electronic air cleaners have a special compatibility with heat pumps because of their ability to keep the indoor coil clean in winter when it has little or no condensate to help remove airborne dust. They also are effective in removing the short-lived radon daughters that characteristically attach themselves to airborne particles. Eac's cannot, however, remove radon gas.

Still over the horizon is another market which, we think, will develop within the next few years. It's based on increased consciousness of indoor air quality and the ability of eac's to remove pollen and other airborne particulates.

Like humidifiers and other accessories, eac's have been a victim of high interest rates in the past. Now, however, interest rates have moderated somewhat and the replacement market appears to be materially helping eac sales.



Dehumidifiers

Shipments of dehumidifiers achieved a record-setting pace of 704,400 units in 1987, an increase of 26.9% over the previous year's total of 555,100 units. The previous peak was 684,700 units set in 1979, according to the Association of Home Appliance Manufacturers (AHAM).

Looking ahead, however, the manufacturers predict there will be a 15% drop this year to a still-impressive 600,000 units.

The Bureau of the Census reported that 606,830 dehumidifiers were shipped in 1986, the latest year for which these data are available. This represents a 3% increase over the 589,056 dehumidifiers the Bureau said were shipped in the previous year.

Refrigerants

Shipments of the three most common fluorocarbon refrigerants — R-11, R-12, and R-22 — in 1987 totaled 875,887,000 pounds, up 9.8% over the 797,606,000 pounds shipped in the previous year, according to figures released by the U.S. International Trade Commission.

Shipments of R-11 last year totaled 223,401,000 pounds, an increase of 11% over the 1986 total of 201,254,000 pounds.

Shipments of R-12 in 1987 totaled 368,405,000 pounds, an increase of 14.3% over the previous year's total of 322,336,000 pounds.

Shipments of R-22, at 284,081,000

pounds in 1987, were up 3.7% from the 1986 total of 274,016,000 pounds.

In keeping with the international protocol negotiated in Montreal last September, and subsequent regulations proposed by the Environmental Protection Agency in the U.S., world and U.S. production of R-11, R-12, R-113, R-114, and R-115 are likely to be frozen at 1986 production levels in mid-1989.

The freeze probably will be followed by a 50% production cutback of these halogenated fluorocarbons within a decade. The global cutbacks are being mandated in response to the theory that CFC's (chlorofluorocarbons) damage the earth's stratospheric ozone layer with resulting increases in damaging ultraviolet radiation at ground level.

On a world basis (excluding Eastern Europe and China), the Chemical Manufacturers Association (CMA) reported that global production of R-11 and R-12 in 1986 totaled 1,646.7 million pounds, an increase of 6.45% over the 1985 total of 1,546.9 million pounds.

CMA's Fluorocarbon Program Panel based its report on a study prepared by Grant Thornton & Co. The study includes the production of 21 companies in North America, South America, Western Europe, Japan, Australia, Africa, and India.

Known world production of R-11 in 1986 totaled 350,148 metric tons, or 770.3 million pounds, an increase of 7.1% over the 326,814 metric tons, or 718,990,800 pounds, produced in the previous year.

Of the R-11 produced in 1986, it was estimated that 7.4% went for refrigerant end uses, 37% was for closed-cell blowing agent uses, 18.2% was for open-cell blowing agent uses, 30.5% was used as an aerosol propellant, and 6.9% went for other uses.

Known world production of R-12 in 1986 totaled 398,363 metric tons, or 876.4 million pounds, an increase of 5.85% over the 376,339 metric tons, or 827.9 million pounds, produced in 1985.

Of the R-12 produced in 1986, it was estimated that 49.8% went for refrigerant end uses, 9.6% was for closed-cell blowing agent uses, 5.5% was for open-cell blowing agent uses, 29.5% was used as an aerosol propellant, and 5.6% went for other uses.

No estimates of total world production have been made since 1983 because recent CFC production figures have not been available from the U.S.S.R., Eastern Europe, or the People's Republic of China.

Each Statistical Panorama includes the latest data available. Sources frequently revise their previous year's figures, which explains apparent discrepancies between the latest and earlier published data. Where sources give significantly varying information, that data is mentioned.

Canadian heating-cooling market soared last year

Because Canada may soon be a free trade partner with the United States, we thought it might be a good idea to take a look at the size and scope of the Canadian comfort heating and cooling market.

Shipments of residential (under 5 tons) split-system air conditioners and heat pumps in 1987 totaled 119,142 units, up a whopping 68.9% over the 70,548-unit total in the previous year, according to the Heating, Refrigerating, and Air Conditioning Institute of Canada (HRAI).

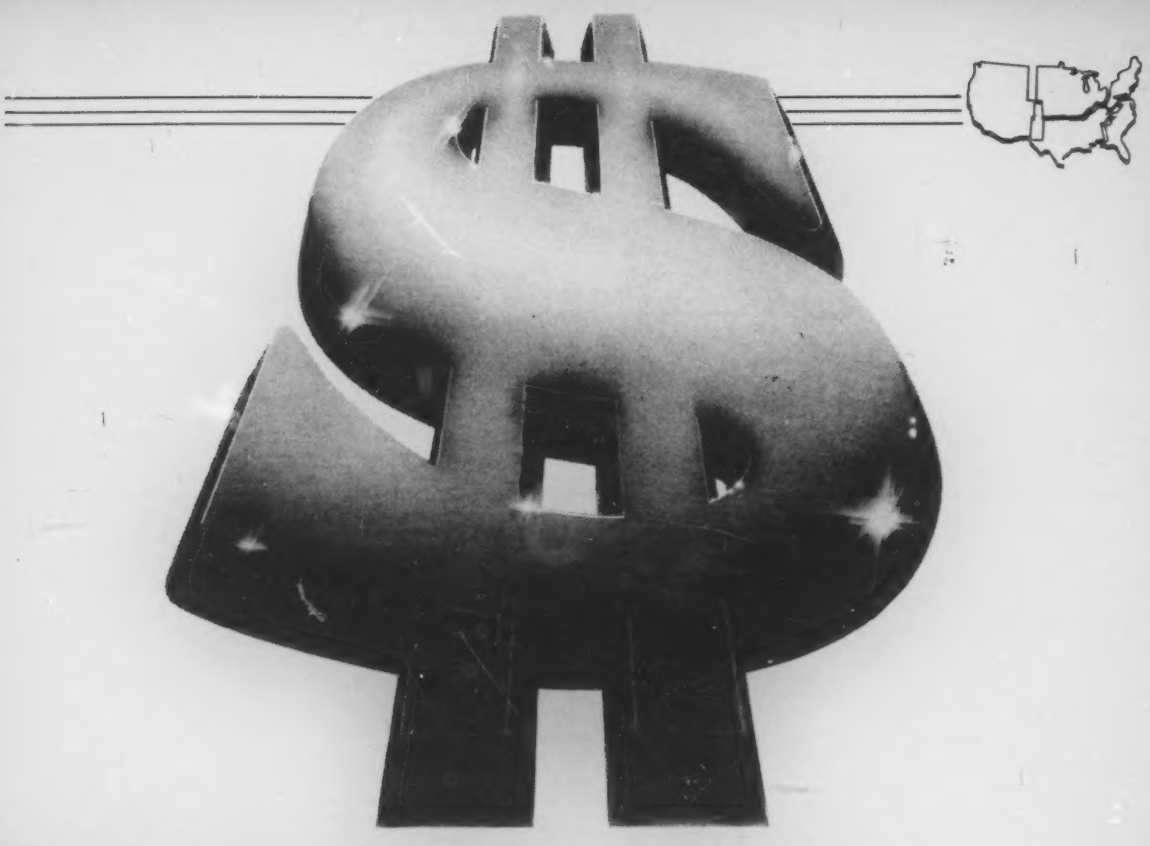
The institute reports that much of the increase last year came because of unseasonably hot weather in Ontario and Quebec, the two prime markets for these products. It is looking for a 21% decline in 1988 to 94,400 units.

Shipments of commercial air conditioners and heat pumps in 1987 totaled 31,443 units, up 12.7% from the 27,889-unit total for 1986. HRAI anticipates a 5.2% drop this year to 29,815 units.

Residential gas, oil, and electric furnace shipments in 1987 totaled 194,862 units, up 11.7% from the total of 174,395 furnaces shipped in the previous year. The outlook for 1988 is for a total of 182,600 furnaces, down 6.3%. These figures were compiled with the assistance of the Canadian Gas Association (CGA) Manufactures Division.

Of the approximately 9.3 million all-year homes in Canada, 52% are heated with warm air furnaces, 25.3% with electric resistance baseboard, 18% with hydronic systems, and 4.7% with heating stoves.

The comfort heating fuel share in Canada is 45.5% gas, 28.5% electric, 20.3% oil, and 5.7% wood.



Here's a statistical portrait of the nation's hvac contractors

On the following pages we present a statistical portrait of the "typical" hvac contractor: what he earns, what he pays his key employees, how much he charges his customers, and much more.

In addition to national figures, we also present contractors' experience according to the region of the country in which they operate. Likewise, we break out contractors by the size of their operations - small, medium, and large. And we also differentiate between unionized contractors and open-shop firms.

A few words about the major categories:

Salaries: The national average for contractor-owners is between $40,000 and $44,000, according to the 585 respondents to our annual survey. There is a fair degree of variability, however. In the Northeast, owners pay themselves between $50,000 and $59,000. In the South, the figure is between $30,000 and $34,000.

Not surprisingly, salary levels follow company volume. Contractors doing less than $100,000 a year — a minority of respondents — pay themselves about $17,000 a year. At the other end of the spectrum, those doing over $3 million average about $75,000.

The disparity is also striking between union shops, whose owners pay themselves an average salary of $75,000. For open shops, the compensation is about $37,000.

Payroll labor costs: The hourly rate tends to bunch up between $10 to $18. More than half of the contractors are in this category.

But the picture changes considerably according to union-nonunion status. Only 13% of unionized contractors pay below $18. The big bulge for them comes between $19 and $29, which is the pattern for two-thirds of them. For open-shop contractors, 75% of them pay less than $19.

Charge-out rates: Again, the national picture shows the bulk of rates is between $25 and $39 per hour. There is no great disparity among the five regions of the U.S. Few contractors charge less than $20 or more than $55 per hour.

But the union-nonunion difference is significant. Unionized shops typically (75% of the time) charge between $35 and $49 per hour. Open shops are found most often in the $25 to $39 per hour region.

Sales per serviceman: There are some wide disparities among sales, according to region and union status. The national average is $63,765; the national median (the midpoint between a range of numbers) is $68,000.

With the exception of the Northeast ($70,977 and $70,000, respectively), the four other regions are close to the national norms. But unionized shop salesmen significantly outperform ($73,600 and $78,750, respectively) their open shop counterparts, who are much closer to the national norms.

The other bulge comes from medium-sized contractors (nine to 49 employees), whose sales forces reported an average of $69,000 and a median of $71,000.

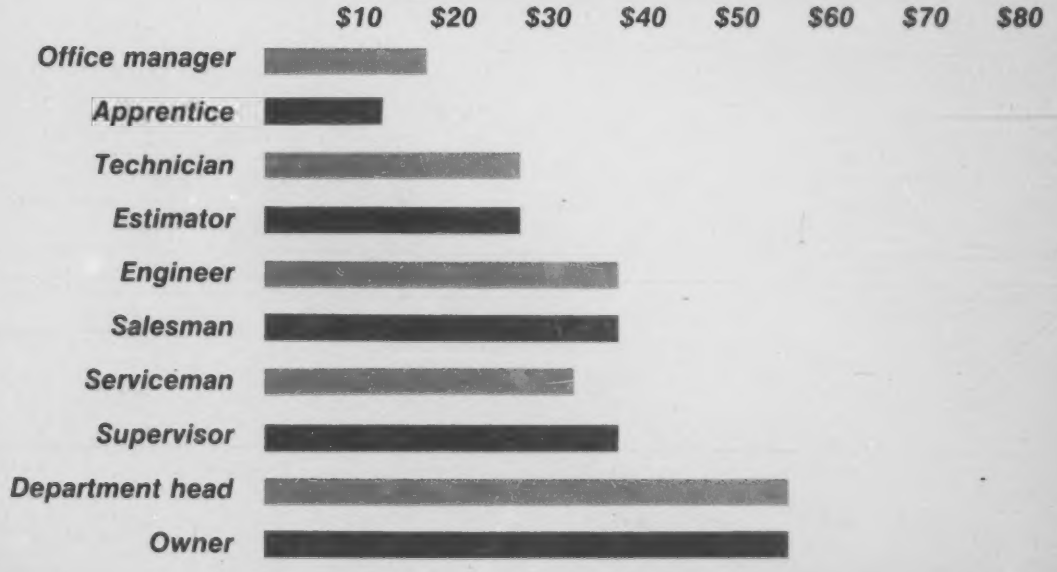
The data on pages 44 through 64 originally appeared in slightly different form in The News in the issues of July 14, 1986, and Nov. 9, 1987.

Average annual salaries - National

(In thousands)

Average annual salaries - Northeast

(In thousands)



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Not only is there a long line of Sporlan solenoid valves with a wide variety of electrical characteristics to handle whatever refrigeration or air conditioning system needs you may have — the E series also comes with long connections.

to make installation easy!

So you can fit and braze without wasting time taking the valve apart. Because it's Sporlan, you know you're installing the best — a valve with proven synthetic materials that assure lasting valve-seat tightness and long service. And to show what great lengths we go to in assuring excellence, every Sporlan solenoid valve is performance tested after assembly to ensure satisfaction.

American materials, American made.

SPORLAN VALVE COMPANY

7525 Sussex Ave. • St. Louis, MO 63143
(314) 647-2775

Export Dept. • 747 Middle Neck Rd., Great Neck, NY 11024 • TLX 62402

Circle 45

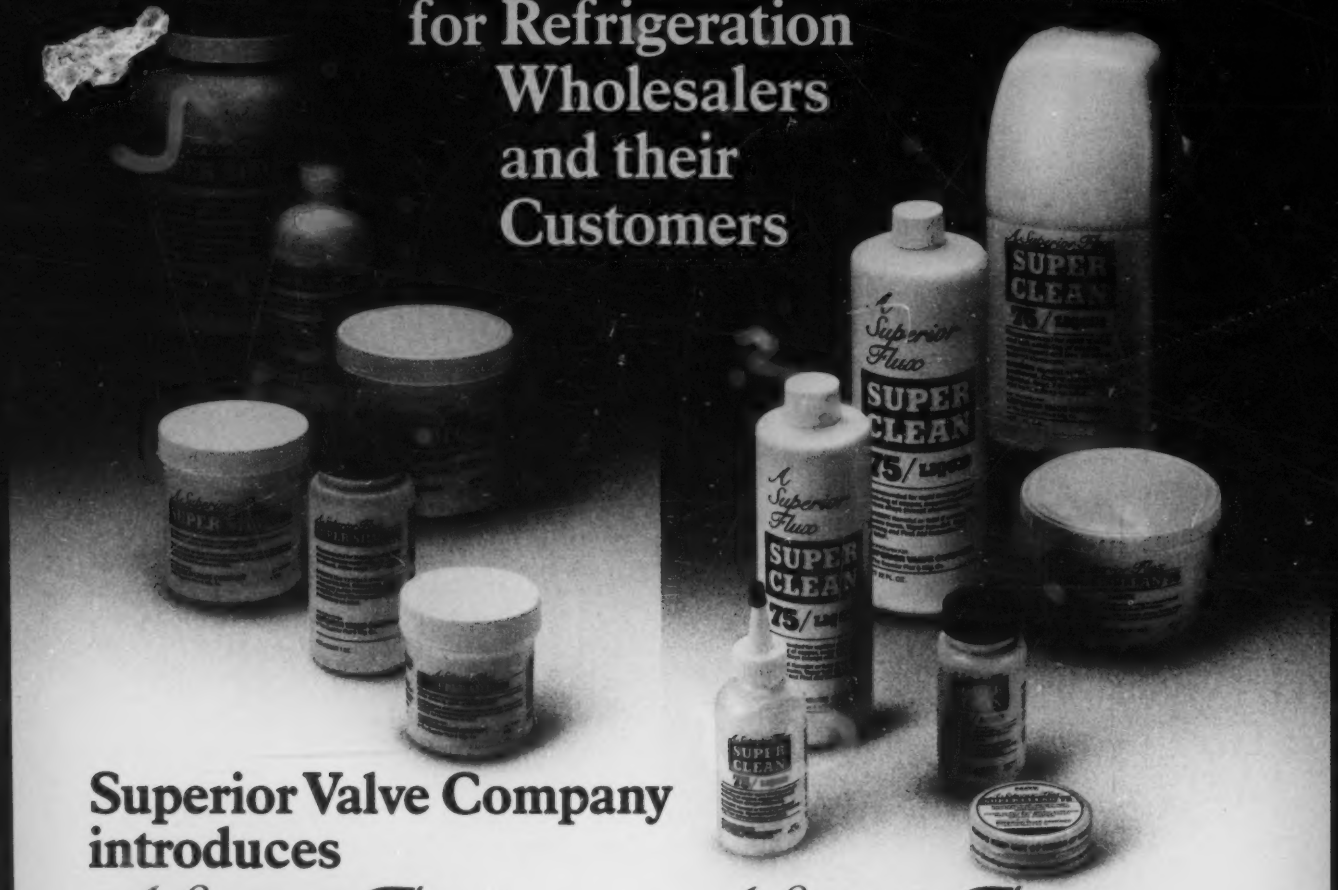
Average annual salaries - Midwest

(In thousands)

Average annual salaries - Southeast

(In thousands)

NOW! A Reliable New Source of Flux for Refrigeration Wholesalers and their Customers



Superior Valve Company introduces

A Superior Flux
SUPER SILV® 601 and *A Superior Flux*
SUPER CLEAN® 75

✓ **Superior products** ✓ **Superior service** ✓ **Superior single source of supply for flux, wrot copper fittings, valves and accessories.**

SUPER SILV® 601: A superior silver solder paste flux recommended for brazing all ferrous and non-ferrous metal alloys (except aluminum). Container sizes: 4 oz., 7 oz. brush cap, 8 oz., 16 oz. (12 oz. squeeze fluxer and 5 lb. jar coming soon).

SUPER CLEAN® 75: A superior soft solder flux that's available in liquid or paste. Recommended for rapid tinning and soft soldering of copper, copper-based and ferrous alloys (not for aluminum). Container sizes: **Liquid** — 4 oz., 16 oz., 32 oz., 1 gallon; **Paste** — 2 oz., 4 oz. brush cap, 16 oz.

For additional information, including literature and pricing, contact your local Superior Valve Company sales representative, Superior Regional Sales Office/Warehouse at (800) 242-5500 [in Texas, call (800) 443-2499], or the factory at (412) 225-8000.
Put us to the test...place an order, today!

SUPERIOR VALVE COMPANY
Division of
AMCAST INDUSTRIAL CORPORATION
2200 North Main Street, Washington, PA 15301 • 412/225-8000 • TWX 510-690-8531 • FAX 412/225-6188

Circle 46

Average annual salaries - South

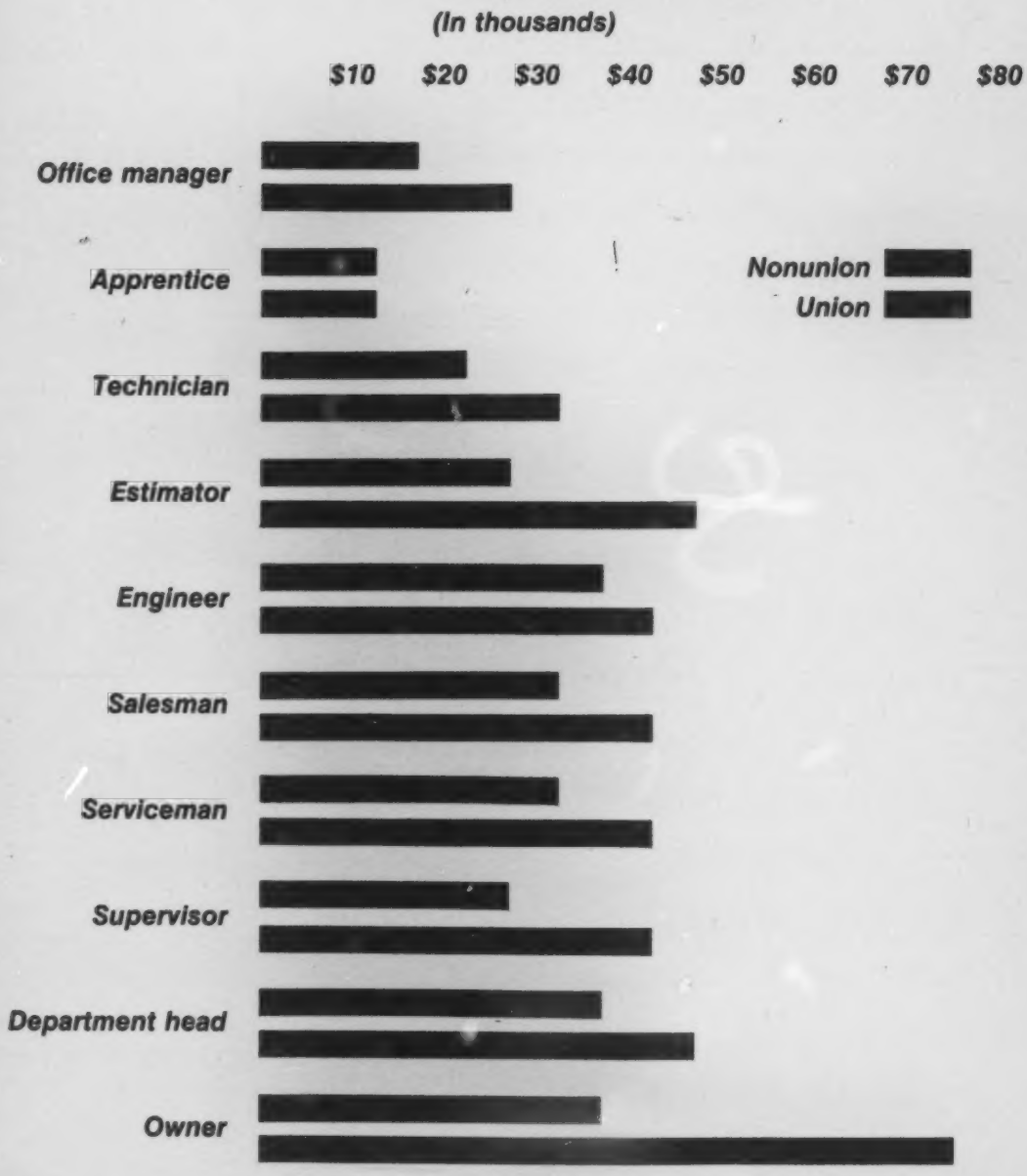
(In thousands)

Average annual salaries - West

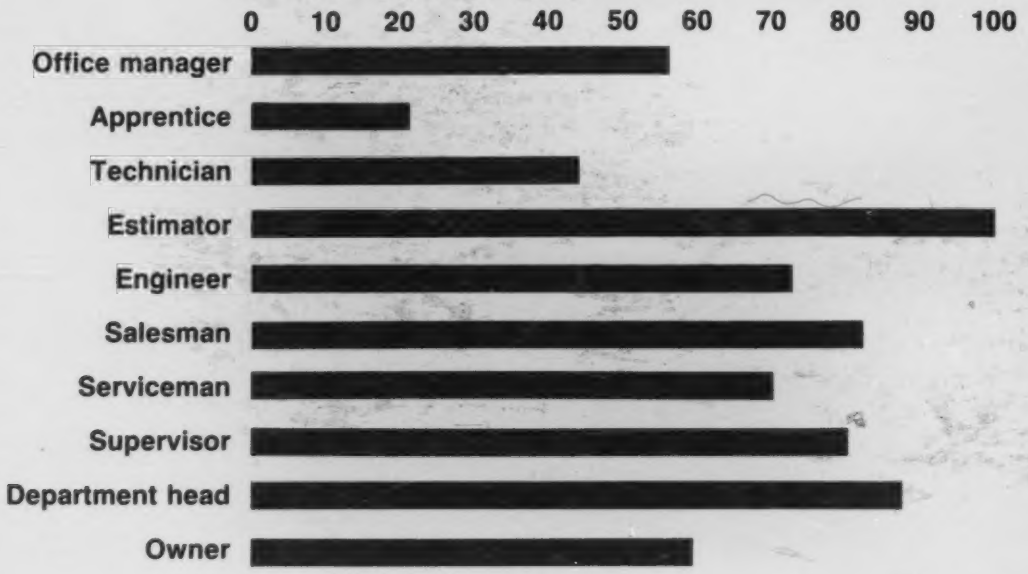
(In thousands)

Average annual salaries

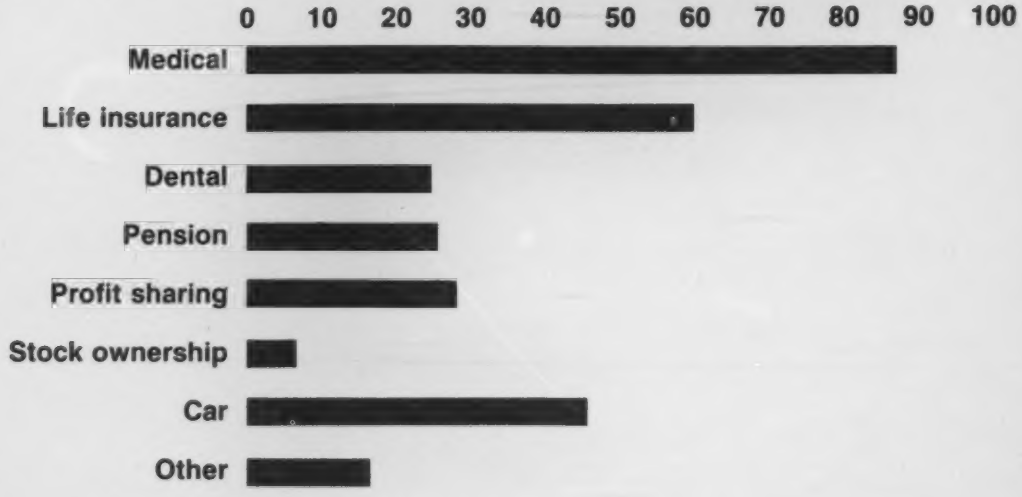
union vs. nonunion shops



% of contractors paying bonuses



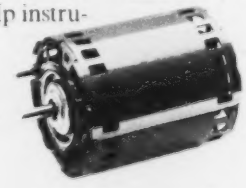
% of contractors paying benefits



Some cats are hard to copy.

Like our new 3.3" "J" Frame Motor.

It's more than redesigned. This superior approach to fractional motor design combines new technology with important economies in the class of 1/250—1/10 Hp instrument-quality motors.



Our new, patented bearing assembly with doubled oil capacity and the optional (also patented!) internal and external shaft seals are designed for longer motor life in all environments. And you can get exactly what you want: stamped steel or aluminum die-cast bearing brackets, self-aligning bearings or solid-mount ball bearings and open or closed construction.

The new Universal Electric "J" Frame Motor. It's the cat they're going to try to copy. For the full story on our "J" Frame Motor line, plus information on our short lead times, automated assembly benefits and other competitive advantages, write to 300 E. Main St., Owosso, MI 48867, or call (517) 723-7866.

MagneTek Universal Electric

Circle 27

Hourly charge-out rates

Rate	% of firms	Vs. U.S. total
Less than $20	1.1%	2.4%
$20 - $24	4.4%	8.8%
$25 - $29	8.8%	13.8%
$30 - $34	24.2%	24.0%
$35 - $39	19.8%	23.1%
$40 - $44	23.1%	14.3%
$45 - $49	6.6%	7.8%
$50 or more	12.1%	6.5%

Hourly payroll labor costs

Costs	% of firms	Vs. U.S. total
Less than $5	1.1%	1.8%
$5 to $9	4.4%	12.2%
$10 - $13	21.1%	26.8%
$14 - $18	37.8%	31.7%
$19 - $24	21.1%	15.9%
More than $25	14.4%	11.6%

Show-up or service charges*

Charge	% of firms	Vs. U.S. total
$1 - $4	—	2.8%
$5 - $9	6.9%	9.6%
$10 - $14	6.9%	12.9%
$15 - $19	37.9%	27.0%
$20 - $24	13.8%	20.8%
$25 or more	34.4%	27.0%

How service calls are assigned

Method	% of firms	Vs. U.S. total
Telephone	47.8%	46.5%
2-way radio	17.8%	38.6%
Roving owner	4.4%	5.2%
Pagers	56.7%	47.4%
Morning check-in	67.8%	62.2%
Other	7.8%	3.5%

Sales per serviceman

	Vs. U.S. total
Average: $70,977	$63,765
Median: $68,000	$68,000

*34% of contractors in the Northeast have a show-up charge.

Midwest

Hourly charge-out rates

Rate	% of firms	Vs. U.S. total
Less than $20	1.8%	2.4%
$20 - $24	18.0%	8.8%
$25 - $29	12.6%	13.8%
$30 - $34	21.6%	24.0%
$35 - $39	20.7%	23.1%
$40 - $44	12.6%	14.3%
$45 - $49	8.1%	7.8%
$50 or more	4.5%	6.5%

Hourly payroll labor costs

Costs	% of firms	Vs. U.S. total
Less than $5	2.8%	1.8%
$5 to $9	11.3%	12.2%
$10 - $13	25.5%	26.8%
$14 - $18	30.2%	31.7%
$19 - $24	18.9%	15.9%
More than $25	11.3%	11.6%

Show-up or service charges*

Charge	% of firms	Vs. U.S. total
$1 - $4	3.8%	2.8%
$5 - $9	11.3%	9.6%
$10 - $14	11.3%	12.9%
$15 - $19	30.2%	27.0%
$20 - $24	18.9%	20.8%
$25 or more	24.4%	27.0%

How service calls are assigned

Method	% of firms	Vs. U.S. total
Telephone	49.5%	46.5%
2-way radio	36.0%	38.6%
Roving owner	6.3%	5.2%
Pagers	44.1%	47.4%
Morning check-in	66.7%	62.2%
Other	1.8%	3.5%

Sales per serviceman

	Vs. U.S. total
Average: $59,356	$63,765
Median: $62,500	$68,000

*49% of contractors in the Midwest have a show-up charge.

Hourly charge-out rates

Rate	% of firms	Vs. U.S. total
Less than $20	1.1%	2.4%
$20 - $24	2.3%	8.8%
$25 - $29	15.9%	13.8%
$30 - $34	30.7%	24.0%
$35 - $39	28.4%	23.1%
$40 - $44	11.4%	14.3%
$45 - $49	4.5%	7.8%
$50 or more	5.6%	6.5%

Hourly payroll labor costs

Costs	% of firms	Vs. U.S. total
Less than $5	1.2%	1.8%
$5 to $9	21.4%	12.2%
$10 - $13	29.8%	26.8%
$14 - $18	32.1%	31.7%
$19 - $24	7.1%	15.9%
More than $25	8.3%	11.6%

Show-up or service charges*

Charge	% of firms	Vs. U.S. total
$1 - $4	—	2.8%
$5 - $9	—	9.6%
$10 - $14	17.5%	12.9%
$15 - $19	26.5%	27.0%
$20 - $24	32.4%	20.8%
$25 or more	23.5%	27.0%

How service calls are assigned

Method	% of firms	Vs. U.S. total
Telephone	48.9%	46.5%
2-way radio	45.5%	38.6%
Roving owner	5.7%	5.2%
Pagers	45.5%	47.4%
Morning check-in	56.8%	62.2%
Other	5.7%	3.5%

Sales per serviceman

	Vs. U.S. total
Average: $65,338	$63,765
Median: $64,375	$68,000

*38% of contractors in the Southeast have a show-up charge.

9029

With refrigeration oil suppliers few and far between, you can count on Sonneborn to come through.

If you want a dependable supply of refrigeration oils, remember this: Sonneborn is a totally integrated supplier. And we have enough crude oil and enough manufacturing capability to meet the entire worldwide need for refrigeration oils.

But that's not the only reason to choose Suniso®

Proven product quality.

Suniso oils have been the industry standard for over 40 years. They have the physical properties to satisfy the most demanding requirements of refrigeration compressor lubrication, including excellent stability and long, trouble-free service.

Proven technical expertise.

The specific technology required for the production of top-quality refrigeration oils is very similar to the technology used in the manufacture of white mineral oils—an area in which Sonneborn has been the leader for more than 75 years. So you can count on us for the technical support you need.

And, backed by the worldwide resources of Witco (a Fortune 250 company), we've made a long-term commitment to this business.

So you can be sure that our high-quality Suniso® oils will be available for many years to come.

Sonneborn Division.

If you need refrigeration oils or information on where to get them, write to: Sonneborn Division, Witco Corporation, 520 Madison Avenue, New York, NY 10022-4236. Or call 212-605-3912.

Witco

Circle 53

Hourly charge-out rates

Rate	% of firms	Vs. U.S. total
Less than $20	3.2%	2.4%
$20 - $24	6.3%	8.8%
$25 - $29	17.5%	13.8%
$30 - $34	23.8%	24.0%
$35 - $39	28.6%	23.1%
$40 - $44	12.7%	14.3%
$45 - $49	6.3%	7.8%
$50 or more	1.6%	6.5%

Hourly payroll labor costs

Costs	% of firms	Vs. U.S. total
Less than $5	—	1.8%
$5 to $9	18.3%	12.2%
$10 - $13	40.0%	26.8%
$14 - $18	28.3%	31.7%
$19 - $24	3.3%	15.9%
More than $25	10.0%	11.6%

Show-up or service charges*

Charge	% of firms	Vs. U.S. total
$1 - $4	4.3%	2.8%
$5 - $9	13.0%	9.6%
$10 - $14	8.7%	12.9%
$15 - $19	17.4%	27.0%
$20 - $24	21.7%	20.8%
$25 or more	34.7%	27.0%

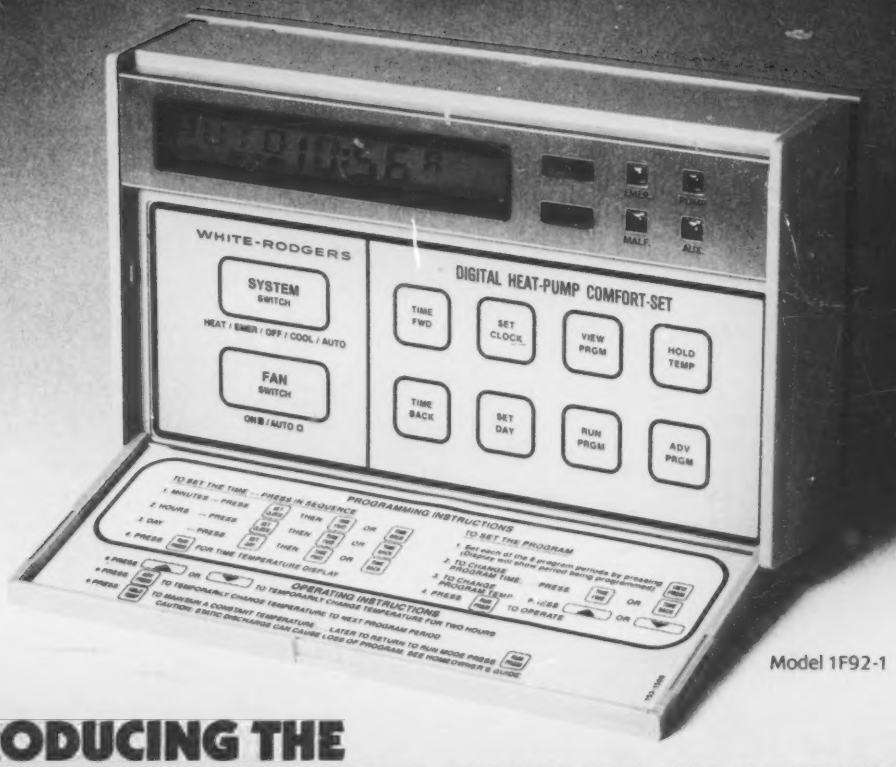
How service calls are assigned

Method	% of firms	Vs. U.S. total
Telephone	38.7%	46.5%
2-way radio	56.5%	38.6%
Roving owner	11.3%	5.2%
Pagers	41.9%	47.4%
Morning check-in	62.9%	62.2%
Other	—	3.5%

Sales per serviceman

	Vs. U.S. total
Average: $67,879	$63,765
Median: $67,916	$68,000

*35% of contractors in the South have a show-up charge.



Model 1F92-1

INTRODUCING THE WHITE-RODGERS 1F92 DIGITAL HEAT PUMP COMFORT-SET® THERMOSTAT.

Finally. A Universal Digital Heat Pump Thermostat With 1F90 Simplicity.

At last, a universal, multistage digital heat pump thermostat in the 1F90 tradition. Simple to install. Simple to program. And simple to operate.

Plus, the 1F92 maximizes energy savings and comfort with our computed EMR™ (Energy Management Recovery) program.

Universal. The 1F92 Digital Heat Pump Comfort-Set is compatible with most split and two-speed heat pumps.

Simple to install. The subbase and thermostat are sold as one unit. Terminal strips on the subbase are spaced and identified for easy wiring. No additional wiring is required.

Simple to program. The thermostat comes factory preprogrammed to meet the needs of most people. All that may be required is a slight change in programming to meet individual lifestyles.

Programmable blower control permits continuous or automatic fan operation during any given program period.

Simple to operate. Should any changes be required, programming instructions are located inside the cover.

When any button is depressed to make a change, the thermostat "beeps" to signal that the change has been registered.

And to ensure continuous operation, a 9-volt battery will maintain program up to one week in event of power loss.

Simple to change. By simply pushing the temperature button on the front of the thermostat, the temperature setting can be temporarily changed for two hours. The thermostat then returns to the programmed temperature setting. No need to open the cover to get at the programming buttons.

The "HOLD TEMP" button, when depressed, overrides the program settings and sets a constant temperature. Pushing the "RUN PRGM" button, returns the thermostat to the programmed setting.

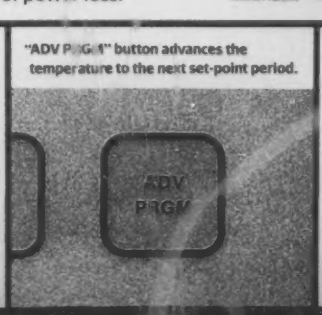
Flexible, too. The Digital Heat Pump Comfort-Set permits up to four separate time/temperature settings per day. And can store two separate sets of time/temperature schedules, one for weekdays and one for weekends. Just like the 1F90. The various temperature settings can be programmed anywhere within the 40 to 99° range.

And reliable. The 1F92 Comfort-Set Thermostat has been designed and field tested to give you the kind of reliability and performance that you've come to expect from White-Rodgers... the expert in temperature control for over 50 years.

Contact your White-Rodgers wholesaler today. Or write White-Rodgers Division, Emerson Electric Co., Station 1301, 9797 Reavis Road, St. Louis, MO 63123.

EMERSON WR **WHITE-RODGERS**
SIMPLY THE BEST.

Simultaneous heat-cool program storage, plus the option of an AUTOMATIC CHANGEOVER setting, eliminates the need to reprogram as the seasons change.



"ADV PRGM" button advances the temperature to the next set-point period.

LED INDICATOR LIGHTS give you a status report of the system at a glance:
1 Indicates system is in emergency mode.
2 Indicates compressor operation.
3 Indicates auxiliary heat activity.
4 Indicates heat pump system malfunctioning.

Circle 52

Hourly charge-out rates

Rate	% of firms	Vs. U.S. total
Less than $20	3.0%	2.4%
$20 - $24	7.6%	8.8%
$25 - $29	15.2%	13.8%
$30 - $34	18.2%	24.0%
$35 - $39	19.7%	23.1%
$40 - $44	13.6%	14.3%
$45 - $49	16.7%	7.8%
$50 or more	6.0%	6.5%

Hourly payroll labor costs

Costs	% of firms	Vs. U.S. total
Less than $5	3.5%	1.8%
$5 to $9	8.8%	12.2%
$10 - $13	21.1%	26.8%
$14 - $18	28.1%	31.7%
$19 - $24	24.6%	15.9%
More than $25	14.1%	11.6%

Show-up or service charges*

Charge	% of firms	Vs. U.S. total
$1 - $4	4.2%	2.8%
$5 - $9	20.8%	9.6%
$10 - $14	16.7%	12.9%
$15 - $19	20.8%	27.0%
$20 - $24	12.5%	20.8%
$25 or more	25.0%	27.0%

How service calls are assigned

Method	% of firms	Vs. U.S. total
Telephone	50.0%	46.5%
2-way radio	40.6%	38.6%
Roving owner	1.6%	5.2%
Pagers	51.6%	47.4%
Morning check-in	57.8%	62.2%
Other	3.1%	3.5%

Sales per serviceman

	Vs. U.S. total
Average: $60,225	$63,765
Median: $65,000	$68,000

*37% of contractors in the West have a show-up charge.

Large contractors

(50 or more employees)

Hourly charge-out rates

Rate	% of firms	Vs. U.S. total
Less than $20	—	2.4%
$20 - $24	3.7%	8.8%
$25 - $29	3.7%	13.8%
$30 - $34	14.8%	24.0%
$35 - $39	29.6%	23.1%
$40 - $44	22.2%	14.3%
$45 - $49	14.8%	7.8%
$50 or more	14.8%	6.5%

Hourly payroll labor costs

Costs	% of firms	Vs. U.S. total
Less than $5	—	1.8%
$5 to $9	—	12.2%
$10 - $13	14.8%	26.8%
$14 - $18	25.9%	31.7%
$19 - $24	25.9%	15.9%
More than $25	33.3%	11.6%

Show-up or service charges*

Charge	% of firms	Vs. U.S. total
$1 - $4	14.3%	2.8%
$5 - $9	—	9.6%
$10 - $14	14.3%	12.9%
$15 - $19	57.1%	27.0%
$20 - $24	14.3%	20.8%
$25 or more	—	27.0%

How service calls are assigned

Method	% of firms	Vs. U.S. total
Telephone	44.4%	46.5%
2-way radio	59.3%	38.6%
Roving owner	3.7%	5.2%
Pagers	48.1%	47.4%
Morning check-in	48.1%	62.2%
Other	3.7%	3.5%

Sales per serviceman

	Vs. U.S. total
Average: $63,700	$63,765
Median: $60,000	$68,000

*26% of large contractors have a show-up charge.

Medium contractors

(9 to 49 employees)

Hourly charge-out rates

Rate	% of firms	Vs. U.S. total
Less than $20	1.6%	2.4%
$20 - $24	3.1%	8.8%
$25 - $29	7.8%	13.8%
$30 - $34	27.1%	24.0%
$35 - $39	21.9%	23.1%
$40 - $44	22.4%	14.3%
$45 - $49	9.9%	7.8%
$50 or more	6.2%	6.5%

Hourly payroll labor costs

Costs	% of firms	Vs. U.S. total
Less than $5	—	1.8%
$5 to $9	5.8%	12.2%
$10 - $13	24.3%	26.8%
$14 - $18	33.9%	31.7%
$19 - $24	21.2%	15.9%
More than $25	14.8%	11.6%

Show-up or service charges*

Charge	% of firms	Vs. U.S. total
$1 - $4	2.6%	2.8%
$5 - $9	11.5%	9.6%
$10 - $14	15.4%	12.9%
$15 - $19	29.5%	27.0%
$20 - $24	19.2%	20.8%
$25 or more	21.7%	27.0%

How service calls are assigned

Method	% of firms	Vs. U.S. total
Telephone	52.3%	46.5%
2-way radio	50.8%	38.6%
Roving owner	3.6%	5.2%
Pagers	43.5%	47.4%
Morning check-in	56.0%	62.2%
Other	3.1%	3.5%

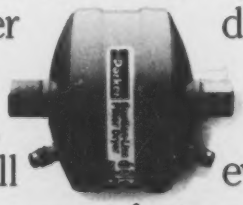
Sales per serviceman

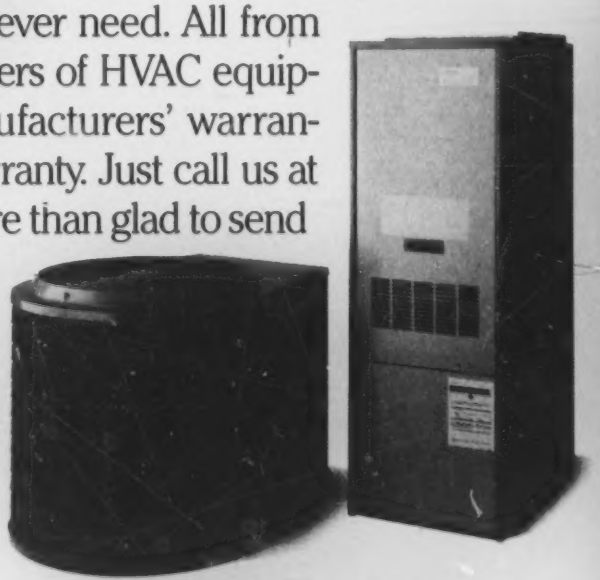
	Vs. U.S. total
Average: $69,000	$63,765
Median: $71,000	$68,000

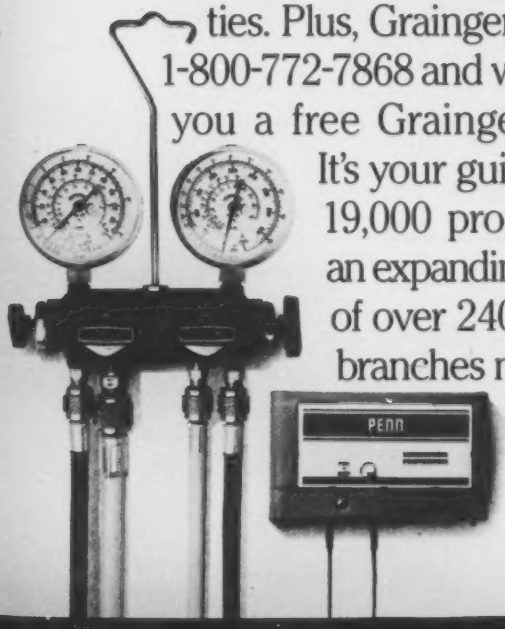
*41% of medium-sized contractors have a show-up charge.

Until now, you've probably heard only parts and pieces of the Grainger story.

Parts and pieces. Motors, belts, pulleys. For HVAC equipment, that's what most people think of when they think of Grainger. Really, nothing could be further from the truth. In the Grainger catalog, you'll find thousands of HVAC products. For all purposes. For all seasons. Everything from central air conditioning equipment to refrigeration equipment, from filter dryers and refrigerant to furnaces and gas valves. We also stock complete lines of blowers, ventilators, fans and practically all the HVAC controls you'll ever need. All from over 58 of the leading manufacturers of HVAC equipment. And all with original manufacturers' warranties. Plus, Grainger's own warranty. Just call us at 1-800-772-7868 and we'll be more than glad to send you a free Grainger catalog. It's your guide to over 19,000 products and an expanding network of over 240 Grainger branches nationwide.







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GRAINGER™

There's a lot more to Grainger than you think.

Circle 13

Small contractors

(1 to 8 employees)

Hourly charge-out rates

Rate	% of firms	Vs. U.S. total
Less than $20	3.3%	2.4%
$20 - $24	12.9%	8.8%
$25 - $29	18.8%	13.6%
$30 - $34	22.9%	24.0%
$35 - $39	23.8%	23.1%
$40 - $44	6.7%	14.3%
$45 - $49	5.4%	7.5%
$50 or more	6.3%	6.5%

Hourly payroll labor costs

Costs	% of firms	Vs. U.S. total
Less than $6	3.6%	1.9%
$6 to $9	19.3%	12.2%
$10 - $13	30.0%	26.8%
$14 - $18	30.5%	31.7%
$19 - $24	10.3%	15.9%
More than $25	6.3%	11.6%

Show-up or service charges*

Charge	% of firms	Vs. U.S. total
$1 - $4	7.2%	2.0%
$5 - $9	9.8%	9.0%
$10 - $14	11.0%	12.9%
$15 - $19	23.1%	27.0%
$20 - $24	9.9%	20.3%
$25 or more	22.0%	27.0%

How service calls are assigned

Method	% of firms	Vs. U.S. total
Telephone	42.4%	46.5%
2-way radio	26.7%	36.6%
Roving owner	6.4%	5.2%
Pagers	50.4%	47.4%
Morning check-in	69.1%	62.2%
Other	3.8%	3.5%

Sales per serviceman

	Vs. U.S. total
Average: $59,900	$63,765
Median: $59,100	$68,000

*37% of small contractors have a show-up charge.

Union shops

Hourly charge-out rates

Rate	% of firms	Vs. U.S. total
Less than $20	—	2.4%
$20 - $24	1.9%	8.8%
$25 - $29	—	13.8%
$30 - $34	13.2%	24.0%
$35 - $39	15.1%	23.1%
$40 - $44	28.3%	14.3%
$45 - $49	28.3%	7.8%
$50 or more	13.2%	6.5%

Hourly payroll labor costs

Costs	% of firms	Vs. U.S. total
Less than $5	—	1.8%
$5 to $9	—	12.2%
$10 - $13	3.8%	26.8%
$14 - $18	9.4%	31.7%
$19 - $24	32.1%	15.9%
More than $25	54.8%	11.6%

Show-up or service charges*

Charge	% of firms	Vs. U.S. total
$1 - $4	2.5%	2.8%
$5 - $9	8.3%	9.6%
$10 - $14	14.6%	12.9%
$15 - $19	27.4%	27.0%
$20 - $24	21.7%	20.8%
$25 or more	25.5%	27.0%

How service calls are assigned

Method	% of firms	Vs. U.S. total
Telephone	75.5%	46.5%
2-way radio	30.2%	38.6%
Roving owner	3.8%	5.2%
Pagers	66.0%	47.4%
Morning check-in	56.6%	62.2%
Other	1.9%	3.5%

Sales per serviceman

	Vs. U.S. total
Average: $73,600	$63,765
Median: $78,750	$68,000

*25% of unionized contractors have a show-up charge.

Nonunion shops

Hourly charge-out rates

Rate	% of firms	Vs. U.S. total
Less than $20	2.9%	2.4%
$20 - $24	8.9%	8.8%
$25 - $29	15.7%	13.8%
$30 - $34	26.0%	24.0%
$35 - $39	23.9%	23.1%
$40 - $44	12.3%	14.3%
$45 - $49	5.0%	7.8%
$50 or more	5.3%	6.5%

Hourly payroll labor costs

Costs	% of firms	Vs. U.S. total
Less than $5	2.2%	1.8%
$5 to $9	14.1%	12.2%
$10 - $13	31.2%	26.8%
$14 - $18	34.8%	31.7%
$19 - $24	12.4%	15.9%
More than $25	5.3%	11.6%

Show-up or service charges*

Charge	% of firms	Vs. U.S. total
$1 - $4	2.5%	2.8%
$5 - $9	8.3%	9.6%
$10 - $14	14.6%	12.9%
$15 - $19	27.4%	27.0%
$20 - $24	21.7%	20.8%
$25 or more	25.5%	27.0%

How service calls are assigned

Method	% of firms	Vs. U.S. total
Telephone	42.2%	46.5%
2-way radio	40.1%	38.6%
Roving owner	5.0%	5.2%
Pagers	44.6%	47.4%
Morning check-in	61.8%	62.2%
Other	4.0%	3.5%

Sales per serviceman

	Vs. U.S. total
Average: $61,890	$63,765
Median: $63,350	$68,000

*41% of nonunion contractors have a show-up charge.

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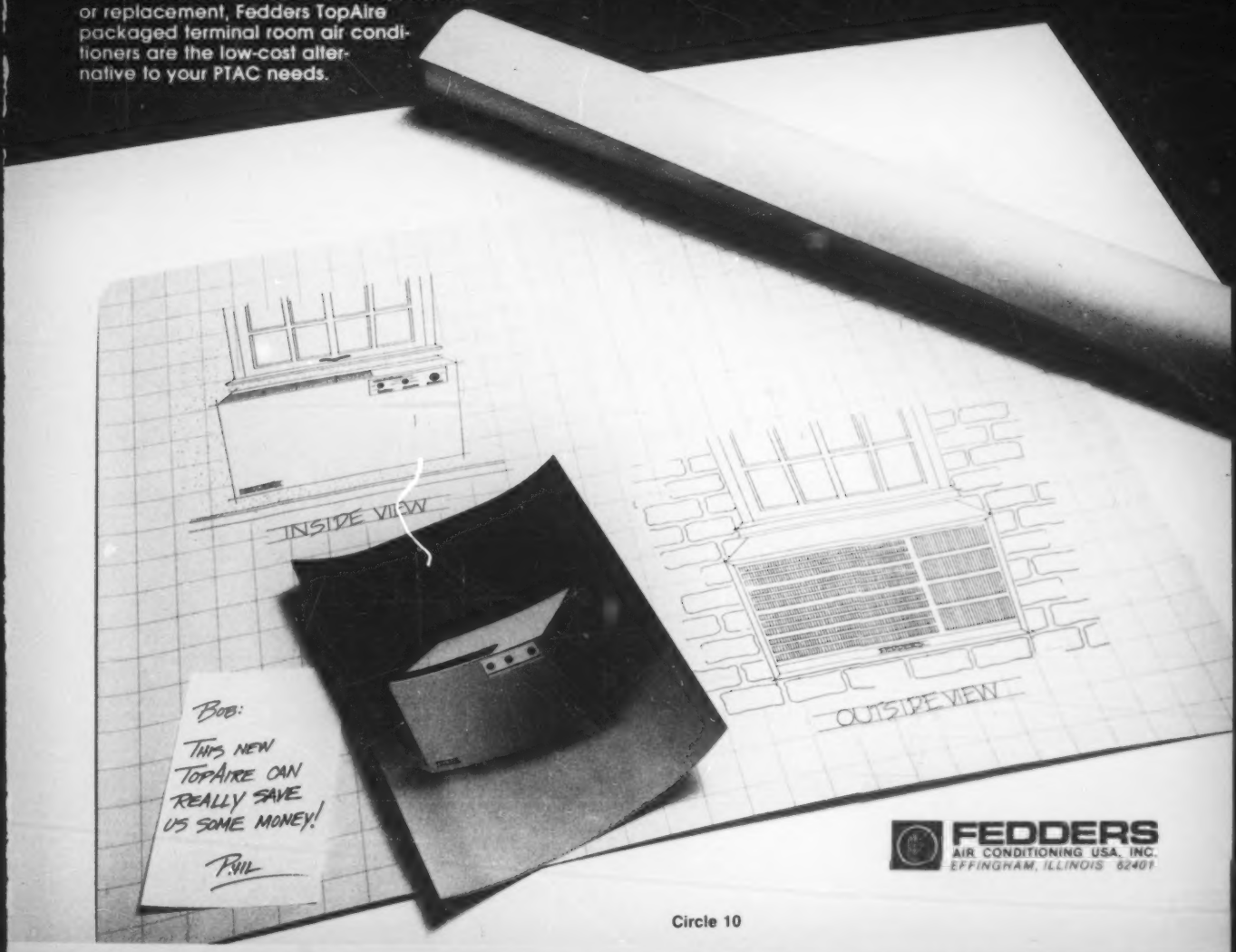

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Circle 10

Electronic air cleaner sales: Is fear motivating consumers?

INDOOR AIR QUALITY problems aren't just caused by radon. Substances like furniture polish, aerosol sprays, cigarette smoke, and even oil paints can be culprits.

by Barbara A. Checket

"We've got lousy air here," claims Albert J. Perri, president, A.J. Perri Co., Westfield, N.J. The air is part of the reason his $2.5-million residential contracting company sells about $100,000 worth of electronic air cleaners each year.

But there's more to it than that. Strong consumer-oriented promotions, radon publicity, and increasing public awareness of indoor air quality have boosted air cleaner sales.

A few years ago, "It was a tough sale to get people to buy a $650 to $700 air cleaner," Perri says. "People were more aware of problems related to humidity."

But, as "philosopher" Mel Brooks once said, fear is a great motivator.

Seeping radon

One of the biggest fears Perri says people have in the company's Monmouth-, Ocean-, Middlesex-county area, is that radon gas is quietly seeping up into their homes, carrying an increased risk of lung cancer.

The fear is so great, "I never mention radon when I go to sell an air cleaner, and none of my salesmen do. It's too negative of an approach."

He doesn't have to mention it. The publicity isn't just in major daily newspapers.

The northern Monmouth edition of the *Asbury Park Press* ran a page-one story last June stating that "Monmouth County residents should test their homes for the radioactive gas and take corrective action if necessary," because elevated radon levels (higher than four picocuries per liter of air) were found in the county.

(Radon gas is created when uranium in the soil decays. It can seep into homes through cracks and openings in the structure and around the foundation. When the gas breaks down into "daughters," they give off alpha radiation, which has been shown to cause lung cancer.)

"Every time stuff like this is published our sales take an upswing," Perri says. "We will talk about it (radon) to customers if they have questions," he says. "We make sure they know that air cleaners won't solve the problem, and that they should call someone to seal the cracks and increase their ventilation. But they don't ask too often."

All an air cleaner can do, in fact, is remove some of the particulate to which the radon daughters can, or have, become attached.

The "natural" sale

Less scary — in fact, almost innocuous by comparison — are sales generated by health factors and indoor air quality (although this may subconsciously mean "radon" for some customers). Air quality sales make up the bulk of the company's air cleaner business.

Middle- to high-income customers are willing to spend more for health and comfort, Perri says. "Air cleaners are becoming a necessity here, like air conditioning."

He even presents promotional material to local doctors and allergists, with the polite suggestion that they might recommend electronic air cleaners to appropriate patients.

"I don't ask them to recommend my company personally,"

IT'S OFTEN EASIER to sell electronic air cleaners with other pieces of equipment, like this furnace, says Al Perri, president, A.J. Perri Co., Westfield N.J.

Perri says. "All I want them to do is recommend the equipment, if they see fit. I advertise air cleaners enough so that I think I'd get most of that work."

Many customers add air cleaners when retrofitting with higher-efficiency equipment, he says. "I sell the air cleaners together with the Lennox 'Pulse' furnace. I explain to them how it can prevent coil cleaning, which can cost a lot of money. Coils weren't designed to be inspected routinely. They're too hard to get at."

Consumer-targeted material from Honeywell helps get the point across.

The company does some new construction, but it's all custom work. However, Perri approaches homeowners in tract housing about two years after they've moved in to see if they want to upgrade their equipment — and buy an air cleaner.

Seasonal sales

A few years back, air cleaners were mainly sold during the preheating season. Not any more, says John Koepcke, founder, owner, and sales manager, Centraire, Minneapolis, Minn.

"The way consumers are buying now, they upgrade everything at once," he says. If they're going to have central air conditioning installed, why not have a better furnace put in? And as long as everything's being taken apart, why not add an air cleaner?

The residential/service/commercial contractor did about $3.5-million worth of work last year, about $65,000 of which

"What we tell customers — and we try to get it across before the sale — is that air cleaners won't get rid of all the dirt. But you wind up with the cleanest dirt in town."

— Godby

was from air cleaners.

He finds the best way to sell them is to combine them in advertising and sales with other types of heating-cooling equipment. "They don't sell well as a separate entity, especially from a residential standpoint."

He, like Perri, sees them going into upscale homes. The company recently installed one in a "nice" house, along with three furnaces and a dehumidifier for the pool.

In most of Minnesota fear of radon and air quality is weaker than it is back east, Koepcke says. People aren't scared by their environment — they just want to make it better.

"Most people buy them for cleanliness," he comments. "They want to improve their environment, and they want to cut down on cleaning their furniture, upholstery, and draperies." This applies to commercial and residential customers.

Neat nuts?

Taking it one step further, "Several of our air cleaner customers have the 'White-Glove Syndrome,' " says Tom Godby, president, Godby Brothers, Indianapolis, Ind.

These customers usually complain more than others about electronic air cleaners, he adds. "Most dust and dirt is gray or brownish," Godby explains. "The air cleaner traps the larger particles that give it that color. What you have left is white dust, which shows up on furniture better.

"What we tell customers — and we try to get it across before the sale — is that air cleaners won't get rid of all the dirt. But you wind up with the cleanest dirt in town."

The 50%-residential, 50%-commercial contractor did $4-million worth of residential work last year. About $90,000 of that was from electronic air cleaners.

Consumers there are aware of radon and health-related problems, he says. "Ball State University in Muncie (Ind.) is making an awful lot of noise about radon. There's been a lot of studies and projects published." But he doesn't try to cash in on radon as a direct selling tool.

And, while air cleaner sales don't rise in correlation to the publicity, "Radon gets people thinking about their environment."

Most of his air cleaner customers buy it for cleanliness, a better lifestyle, and for the benefit of their heating equipment, he says.

Health-related sales make up only a small percentage of the total. "If we tried to target that market here, we'd wind up losing the much larger one."

Godby, like the others, finds the units sell better when they're paired with other major pieces of equipment. And he says public awareness in his area is relatively low.

"Customers don't ask specifically for air cleaners. You have to bring them up. As an industry, we don't do nearly *enough to promote them. We're not making them a stan*dard item."

COMFORT AND

Despite declining prices for both natural gas and fuel oil, and much lower levels of public discussion about energy conservation, it was clear from an analysis of last year's record shipments of home comfort equipment that today's homeowner still is concerned about efficiency.

There was evidence, too, that market forces still are working. The price of electricity has escalated modestly over the past three years while the prices of gas and oil have dropped, a phenomenon that is being directly reflected in the selection of fuels for new homes.

The emphasis on energy efficiency likely will become even more pronounced. The industry is preparing for the implementation, over the years 1989 through 1993, of mandatory federal energy efficiency standards for home heating and cooling equipment.

The standards, approved by Congress early in 1987, will produce additional improvements in overall efficiency by eliminating the last vestiges of inefficient equipment from the marketplace.

Implementation of the standards also underlines the need for training contractors and technicians in the proper installation and servicing of this high-efficiency equipment. This is particularly true for heating equipment, which has become considerably more complex over the past decade.

There were significant shifts in fuel preferences over the past three years, partly because of price changes and partly because of geographic shifts in growth markets.

The dramatic drop in fuel oil prices that began in late 1985 has had a significant impact on the price of natural gas and, to a lesser extent, on electricity prices. This has led to changes in fuel selection and, in the case of gas, in the way its product goes to market.

In the new single-family home market, for example, oil's share in 1985 was 2.6%. Most of these systems were installed in the Northeast. A lesser number were located in the Midwest and a few were located in the Pacific Northwest. The share increased to 4.1% in 1986 and, last year, increased further to 5.2%.

This decline in oil prices also had a significant indirect impact on gas prices. Already troubled by an oversupply "bubble," the gas industry faced a new threat in the form of a sharp drop in the price of residual fuel oil, its chief competitor in the important industrial and electricity generation markets.

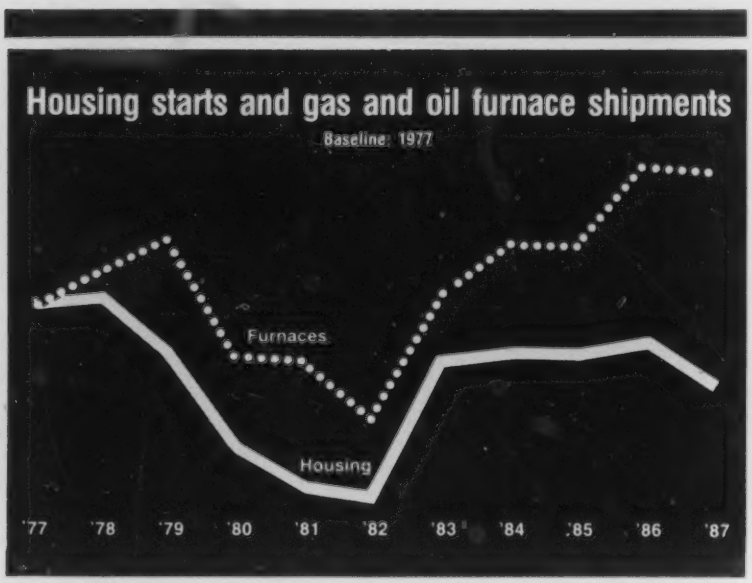
The result was that oil prices, in effect, put a ceiling on most gas prices. By 1986, more than half of industrial gas sales and more than 90% of gas sales to utilities were sold through nontraditional carriage arrangements made with producers and pipeline operators rather than the local gas utility. Even large commercial accounts with dual fuel capability began buying direct from producers.

This turmoil also had an effect on residential gas prices, which declined by 6.7% in 1986 and by another 8.7% last year. The 19.9% drop in residential fuel oil prices in 1986 was followed by a 4% decline through the first 10 months of last year.

The cost of electricity, a major concern in the South where cooling seasons are long and where most heat pumps and electric heating systems are located, has been increasing slowly but steadily. The increase through the first 10 months of 1987 was 2.4% over the average for 1986.

As a result of these shifts, the gas share of the new single-family home market increased from 43.4% in 1985 to 46.8% in 1986 and 50.7% last year. The electricity share, under attack by both gas and oil, declined from 49.9% in 1985 to 45.6% in 1986 to 40.6% last year. The heat pump share of this market dropped from 30% in 1985 to 29% in 1986 and 27.3% last year.

It should be noted, however, that not all of this shift was the direct result of fuel price changes. Home construction in the South, bastion of the heat pump and electric furnace, has slumped dramatically while home starts in the Northeast and Midwest, bastions of oil- and gas-fired equipment, have bounced back strongly.



A look back

To provide some fuel price perspective, it must be remembered that today's "low" oil prices still are 65% higher than they were in 1978. We use the term "low" because these prices have declined by 32.2% from a high in 1981 of $1.19/gal plus taxes.

Similarly, the average price of natural gas delivered to U.S. homes in October of last year was $4.64/1,000 cu ft. That represented a 260% increase over 1973 prices and an 81.3% increase over 1978 prices. This latest available price, however, was 8.7% lower than

CONSTRUCTION

the 1986 average and 10.3% lower than average gas prices in 1982.

The price of electricity charged residential customers, which averaged 7.99 cents/kWh in October, 1987, was 85.4% higher than the 4.31 cents/kWh charged in 1978 and 214.5% higher than the 2.54 cents/kWh charged in 1973.

Back in the early 1970's the efficiency of an air conditioner, a heat pump, a furnace, or a boiler was largely an academic consideration. The few who made or marketed equipment with efficiencies markedly ahead of their competitors could find few who appreciated the difference enough to pay the premium cost. Price was supreme and equipment was considered almost a commodity.

The Arab oil embargo in 1973 initiated the uneven fuel price increases that were to follow. These changes, and the perceptions they have created among consumers and legislators, have had a major impact on the home comfort industry.

As energy prices escalated, manufacturers and distributors found they could no longer serve the market with any single efficiency. Contractors found that homeowners were demanding higher efficiencies for replacement and add-on equipment. Later, builders found that tighter, better insulated homes and high-efficiency heating and cooling equipment sold more quickly.

During the intervening years, manufacturers were forced to market cooling equipment lines of two, and even three, efficiency ranges. Real and threatened state minimum efficiency standards helped the process. About six years ago, home heating equipment followed suit and, today, most manufacturers offer furnaces and boilers in three efficiency ranges.

In the early stages, the avoidance of high operating cost took the form of added insulation, weatherization, the elimination of pilots on gas-fired appliances, more coil surface on air conditioners and heat pumps, and an interest in solar, wood, and other renewable energy sources.

The second phase — the adoption of new technology coupled with a consumer willingness to pay a premium for increased equipment efficiencies — had its beginnings in 1979 but did not develop fully until 1984. No longer were furnaces considered extensions of the ductwork, nor was there competition to see how little coil surface was needed for a given capacity.

The final phase began in 1983 and

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will be with us for the forseeable future. It's a time in which both consumer and government education is largely complete. And although the coming federal minimums are a bit higher than we'd like, there still will be room for competition at the top. In addition, the interval between now and 1992 should provide an orderly upward progression without market disruptions.

The march toward higher efficiencies so far has been marked by the ability of industry to provide the efficiencies demanded in the marketplace and by the consumer's unexpectedly high level of understanding about the extra investment required. Although electric utility incentives surely helped, they were not the deciding factor.

We don't expect any quantum leaps in overall average efficiencies as the industry prepares for the mandatory minimums. We won't know until late 1994 whether the mandatory minimums will constitute only a floor or whether they will, in effect, constitute both a floor and ceiling.

Heating

In the days of cheap and abundant natural gas, there was little incentive to purchase anything better than an inherently reliable and inexpensive atmospheric gas furnace or boiler with a standing pilot that, in most cases, burned all summer long to keep rust and dampness from the simple clamshell heat exchanger.

These atmospheric gas furnaces and boilers had a steady state efficiency of at least 80% but, on an annual basis, they had to press hard to achieve efficiencies in the 60% range. The natural venting arrangment also meant that conditioned air was lost up the flue whether the furnace was operating or not.

With the first stage of natural gas decontrol in 1978, along with the elimination of the curtailments of the previous decade, came steep price increases that more than doubled operating costs. The first remedy, made mandatory in some states, was the intermittent ignition device (iid) to replace the standing pilot. This increased seasonal efficiencies to the 67%-71% range and a vent damper, which reduced the amount of conditioned air vented between cycles, could add another 8% or so.

The next stage was a family of gas-fired equipment with power burners, induced draft, or recuperative heat exchangers. They constituted a new class of equipment with seasonal efficiencies in the 80% to 86% range. They stopped just short of condensing the flue gases.

A pulse combustion boiler was introduced in 1980 and, two years later, it was joined by a pulse combustion furnace. Both had seasonal efficiencies well above 90% and yet another efficiency class was born. Within the next three years virtually every manufacturer entered the market with a condensing furnace that sported seasonal efficiencies of 90% or more.

These changes were not without incident. The corrosive nature of flue gas condensate, plus the corrosive chemicals introduced into the home environment from such things as cleaning compounds, caused many problems with the early installations. Even furnaces that were not designed to condense flue gases did so under certain conditions.

The efficiency market

Concentrated industry research has removed most of these early problems. Virtually all now use superior stainless steel alloys in secondary heat exchangers. New venting standards have been developed. Some use outdoor air for combustion. And some — but by no means all — contractors have been trained in proper installation and service procedures.

Although some manufacturers were unaware of it at first, there was a comparatively large group of homeowners eager to control fast-rising energy bills. They watched the evolution of efficiencies with more than passing interest. When they began replacing inefficient equipment in good working order with new equipment for reasons of efficiency, a whole new market was born.

One manufacturer reported that more than 80% of its condensing furnaces are being used to replace furnaces in good working order. And although others do not claim this high a percentage, it appears clear that most high-efficiency units are being used as replacements for failed or inefficient furnaces for reasons of efficiency.

A breakdown of manufacturer shipments by efficiency range reported by the Gas Appliance Manufacturers Association (GAMA) illustrates the scope of the change in consumer buying habits. The report includes upflow, downflow, and horizontal furnaces.

In 1983, the first year these statistics were reported, 26.7% of all furnaces shipped had an AFUE (annual fuel utilization efficiency) of less than 65%. Only five years before, this classification had represented nine out of every 10 furnaces sold.

Last year furnaces with AFUE's of less than 65% accounted for only 11%

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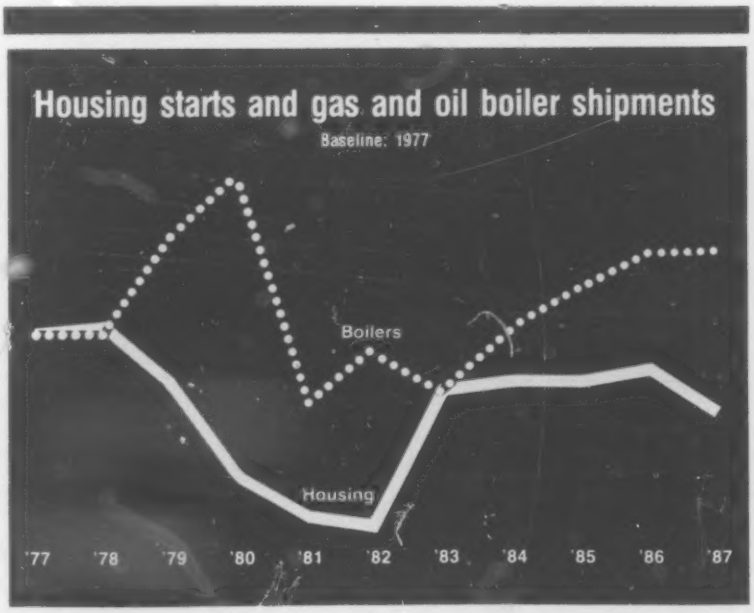

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Circle 26

of the total, or 227,000 of more than 2 million units shipped, down from 13.5% a year earlier.

At the other end of the spectrum, 15.4% of the furnaces shipped in 1983 had AFUE's of 80% or better. Last year, 33% of the furnaces shipped, or 684,600 units, had AFUE's of 80% or better, up from 30.9% in 1986. Of the total, 16.1% — or 333,876 — furnaces shipped last year had AFUE's of 86% or better, up from 15.1% in the previous year.

In between these extremes, 41.5% of the furnaces shipped last year, or 859,926 units, had AFUE's of between 65% and 71%, down from 44.8% the year before. Similarly, 14.5% of the total, or 301,344 furnaces, had AFUE's of between 71% and 80%.

The figures demonstrate that a third or more of all of the gas furnaces sold today already meet or exceed the new federal minimums. It also demonstrates that the technology and the products required to meet those minimums are in place.

Other figures supplied by GAMA showed that the picture for oil-fired furnaces was a bit different. In 1983, a total of 24.2% of the oil furnaces shipped had an AFUE of 80% or better. Last year the percentage had increased to 55.4% of shipments, or 114,384 units, up slightly from 52.4% in 1986.

Oil-fired furnaces with AFUE's in the 75% to 80% range shipped last year accounted for 39.3% of the total, or 81,190 units, down from 41.6% in 1986. Only 5.3% of oil furnaces shipped in 1987 had AFUE's of less than 75%, down from 6.1% the previous year. There are very few condensing oil furnaces.

It should be noted that there are two exceptions to the 78% AFUE minimum standard for furnaces manufactured after Jan. 1, 1992. The minimum AFUE for mobile home furnaces is 75% and, for furnaces with inputs of less than 45,000 Btuh, a minimum somewhere between 71% and 78% has yet to be established by DOE.

While the industry appears to be agreed on such subjects as plastic vents and better stainless steel formulations, it's still divided on whether or not it's best to use outdoor air for combustion.

Some argue that indoor air often is laden with household cleaning and cooking gases that, when combined with gas or oil flames, produce corrosive acids. Even vapor from chlorinated public water supplies is a suspected villain. And in Canada, public authorities are considering a requirement that condensate from furnaces be neutralized before it's deposited in public sewers.

Still needed are guidelines for common venting with other appliances, such as gas-fired domestic hot water heaters, and for general ventilation to control the build-up of humidity and indoor contaminants caused by cooking, cleaning, and bathing. Both the research community and the manufacturers are working on answers to these questions.

Heat pumps

Electric furnaces for many years merely replaced electric resistance baseboard and ceiling cable systems so that ducted central cooling also could be provided. In the 1980's, however, they have been playing second fiddle to the heat pump.

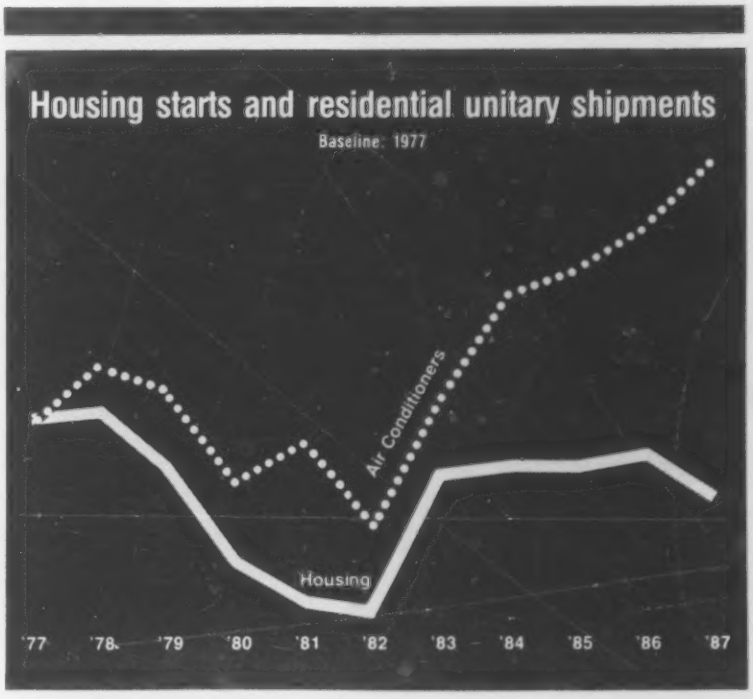
In recent years heat pumps have accounted for more than a quarter of all single- and multifamily homes built in the U.S. The heat pump share of new single-family home market in 1987, at 27.3%, slipped for the third year in a row. This was due as much to the slow housing market in the South as to higher electricity prices.

It should be noted that heat pump penetration among single-family homes in the South, which was constant at 44.8% for 1985 and 1986, rose to 47.8% in 1987, or more than three times the penetration in any other region of the country.

The initial reason for the popularity of the air-to-air heat pump was the lack of natural gas availability in many markets until 1978. When gas became plentiful, it suffered from steep price increases and sparse infrastructure in the growth markets of the South. Even in 1987, after three years of sharp declines, the South accounted for 42% of single-family and 37% of multifamily home completions.

A small market that surged briefly and then declined was the replacement of split-system air conditioners with split-system heat pumps on gas, oil, and electric furnaces. The heat pump provides summer cooling and heating in the spring and fall. The furnace takes over for the winter. The switching point depends on the relative fuel prices.

Several contractors have reported that, in areas where utilities pay incentives for high-efficiency heat pumps, it often costs a homeowner only a couple of hundred dollars to replace a worn



out or inefficient air conditioner with a heat pump. However, the resurgence of this market probably is quite spotty.

Of perhaps more importance is the realization that a significant number of larger, custom homes contain more than one unit. Multiple units are used instead of zoning different parts of the house. One manufacturer estimates that the use of multiple units applied to 11% of all single-family starts in 1986 and 16% in 1987. The ratio applies to air conditioners, heat pumps, and furnaces.

The heat pump has a magic about it that the gas industry envies. It has devoted a lot of time and money to the development of gas-fired heat pumps that can compete head-on with electric heat pumps. The results of that research, however, appear to be still several years away from the marketplace.

A new approach, the integrated system, is enabling the gas industry to compete with heat pumps in some markets. It consists of a gas-fired hot water heater that provides both domestic hot water and hot water for a coil in a separate air handler that, in turn, connects to ductwork to provide space heating. An air conditioning evaporator also can be fitted into the air handler to provide comfort cooling.

Although these systems have yet to impact on heat pumps nationally, they have enabled gas utilities to regain some of the apartment and condominium market share lost when rising energy costs influenced developers to adopt separate comfort systems along with separate meters.

The performance of electric air-to-air heat pumps has improved significantly in recent years. Cooling performance, although still a compromise, has been upgraded to the point where it now rivals the best cooling-only units.

The Air-Conditioning and Refrigeration Institute (ARI) reported that, of 1987 shipments, the sales-weighted average of all unitary heat pumps of 65,000 Btuh and under was 8.93 SEER (seasonal energy efficiency ratio), up from 8.70 a year earlier. Back in 1976, when records of this type were first kept, only 4.5% of residential heat pumps shipped that year could boast of an EER of 8.5 or better.

Looked at another way, 73% of the residential heat pumps shipped last year had an SEER of 8.5 or better, up from 50% a year earlier, and 93% of residential heat pumps shipped last year had an SEER of 8 or better, up from 90% in 1986.

Even so, the industry average still has a way to go to match the mandatory federal minimum efficiency of 10 SEER for split-system and 9.7 SEER for single-package heat pumps manufactured after Jan. 1, 1992, and 1993 respectively. On the positive side, most manufacturers already offer units that meet or exceed the new standard.

Even though their total numbers are much smaller, water-source heat pumps have been making themselves felt in some northern markets, particularly in the Midwest. They have been used in the South, particularly Florida, for many years.

Most of the early "cold water" units used water from a well, a pond, or the ocean. Water quantity and quality often were unknown until the job was started. Too, many required a return well. For these reasons, most installa-

TURN TO PAGE 75

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Heating-cooling-fuel new home characteristics

	U.S. total	Northeast	North Central	South	West	U.S. total	Northeast	North Central	South	West
Single-family homes completed	**800,000**	134,000 16.7%	113,000 14.1%	370,000 46.2%	184,000 23%	**1,141,000**	204,000 17.9%	200,000 17.5%	479,000 42%	258,000 22.6%
Space heating fuel										
Gas	374,000 46.8%	58,000 43.3%	88,000 77.7%	111,000 30%	116,000 63%	557,000 50.7%	87,000 15.1%	165,000 28.6%	153,000 26.5%	172,000 29.8%
Electricity	365,000 45.6%	42,000 31.3%	21,000 18.6%	248,000 67%	55,000 29.9%	762,000 40.6%	56,000 12%	28,000 6%	313,000 67.7%	66,000 14.3%
Oil	33,000 4.1%	29,000 21.6%	1,000 0.9%	1,000 0.3%	— —	59,000 5.2%	55,000 93.2%	2,000 3.4%	1,000 1.7%	— —
Other/none	29,000 3.6%	5,000 3.7%	4,000 3.5%	11,000 3%	12,000 6.5%	40,000 3.5%	5,000 12.5%	5,000 12.5%	10,000 25%	20,000 50%
Heating system type										
Central heating	719,000 89.9%	109,000 81.3%	106,000 93.8%	342,000 92.4%	161,000 87.5%	1,029,000 90.2%	172,000 84.3%	191,000 95.5%	445,000 92.9%	221,000 85.7%
Warm air ducted	668,000 83.5%	64,000 47.8%	104,000 92%	342,000 92.4%	160,000 87.5%	946,000 82.9%	95,000 46.6%	187,000 93.5%	443,000 92.5%	220,000 85.3%
Warm air furnace	437,000 54.6%	45,000 33.6%	94,000 83.2%	175,000 47.3%	124,000 67.4%	635,000 55.7%	66,000 32.4%	172,000 86%	214,000 44.7%	181,000 70.2%
Heat pump	232,000 29%	20,000 14.9%	10,000 8.8%	166,000 44.8%	36,000 19.6%	311,000 27.3%	28,000 13.7%	16,000 8%	229,000 47.8%	39,000 15%
Hydronic	50,000 6.3%	45,000 33.6%	3,000 2.7%	— —	1,000 0.5%	84,000 7.4%	77,000 37.8%	5,000 2.5%	— —	1,000 0.4%
Built-in	80,000 10%	24,000 17.9%	8,000 7%	27,000 7.3%	22,000 12%	108,000 9.5%	30,000 14.7%	8,000 4%	34,000 7.1%	36,000 14%
Electric	45,000 5.6%	19,000 14.2%	5,000 4.4%	10,000 2.7%	9,000 4.9%	61,000 5.4%	26,000 12.8%	5,000 2.5%	16,000 3.3%	15,000 5.8%
Other/none	37,000 4.6%	4,000 3%	2,000 1.8%	16,000 4.3%	13,000 7%	47,000 4.1%	4,000 2%	3,000 1.5%	17,000 3.6%	22,000 8.5%
With central air conditioning	559,000 69.9%	59,000 44%	69,000 61%	340,000 91.9%	91,000 49.5%	806,000 70.6%	95,000 46.6%	135,000 67.5%	440,000 91.9%	137,000 53.1%
Multifamily homes completed	**467,000**	43,000 9.2%	71,000 15.2%	196,000 42%	157,000 33.6%	**584,000**	62,000 10.6%	101,000 17.3%	218,000 37.3%	205,000 35.1%
Space heating fuel										
Gas	156,000 33.4%	22,000 51.2%	29,000 40.9%	25,000 12.8%	81,000 51.6%	232,000 39.7%	36,000 58%	55,000 54.5%	32,000 14.7%	109,000 53.2%
Electricity	301,000 64.5%	13,000 30.2%	32,000 45%	171,000 87.2%	74,000 47.1%	336,000 57.5%	17,000 27.4%	43,000 42.6%	184,000 84.4%	91,000 44.4%
Oil	6,000 1.3%	5,000 11.6%	— —	— —	— —	6,000 1%	6,000 9.7%	— —	— —	— —
Other/none	4,000 0.9%	1,000 2.3%	— —	1,000 0.5%	2,000 1.3%	14,000 2.4%	2,000 3.2%	2,000 2%	1,000 0.5%	6,000 2.9%
With air conditioning	410,000 87.8%	35,000 81.4%	67,000 94.4%	194,000 98.9%	114,000 72.6%	511,000 87.5%	51,000 82.3%	95,000 94%	215,000 98.6%	148,000 72.2%

SOURCE: Two quarters revised, one quarter preliminary. Census Bureau figures. All numbers are rounded. Built-in "electric" includes electric baseboard, panel, or radiant heat. Built-in "other" includes room or space heaters, floor or wall furnaces, solar, and other types of heating.

tions were in rural areas.

These systems in recent years have been replaced by vertical and horizontal closed loops filled with water and antifreeze that have substantially reduced both drilling and pumping costs. What's more, they can be installed on smaller urban lots.

They provide high-efficiency water-cooled air conditioning in summer and high-efficiency heating in winter without the need for either defrost or a back-up heating system. But first costs are high — about two to three times the cost of a high-efficiency gas furnace — and they require special design and application skills.

Air conditioning

In the late 1960's and early 1970's the condenser surfaces of central air conditioners got smaller and smaller while condenser fan speeds got higher and higher as manufacturers tried to hold the line on price in a competitive market dominated by builder purchases.

The EER's (energy efficiency ratios) didn't matter so long as the first cost was low. Electricity was cheap and, after all, the builder didn't have to pay the utility bills. But as electricity bills spiraled upward, particularly in the South where cooling seasons are long, the industry began to develop equipment with higher efficiencies.

In the early stages builders held to low-cost, low-efficiency units. But as homebuyers became more knowledgeable and more demanding, and as manufacturers developed equipment with higher efficiencies for the more discerning add-on and replacement markets, builders began opting for better units as part of an energy-saving merchandising package.

Within the hvac industry, condenser surfaces were expanded, multiple-speed condenser fans were added, and compressor sizes got smaller. The units got quieter as well and the push by municipalities for sound ordinances to control air conditioner noise all but disappeared. Too, as air conditioning penetration increased, more windows were closed at night.

Compressors were improved and two-speed models were introduced by several manufacturers. Commercial units began to be routinely equipped with multiple compressors to provide more modulation and, as a side benefit, lower cost because of the economies of scale in the manufacture of the

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smaller compressors.

Within the past few years, manufacturers have started to use enhanced inner tube surfaces and more effective fin designs to reduce the size of condenser and evaporator coils. A few offer inverter drives. And the scroll compressor, long heralded for its toughness and efficiency, made its debut in 1987. Three more manufacturers will make limited use of scroll compressors this year.

Until 1976, we doubt that much more than 15% of residential units (65,000 Btuh and under) shipped could be classified as high-efficiency units. At that time, an EER of 7.5 was posted by us as the dividing line. That picture has changed dramatically.

ARI reported that, of 1987 shipments of unitary air conditioners in this class, the sales-weighted average SEER was 8.97, up from 8.87 a year earlier.

Looked at another way, 70% of the residential central air conditioners shipped last year had an SEER of 8.5 or better; 94% had an SEER of 8 or better; and 98% had an SEER of 7.5 or better.

A major benefit of the federal legislation will be the elimination of state minimums. Not only have these state minimums created a number of minimarkets that destroy the economies of scale, but the "me, too" and "me, toughest" leapfrog syndromes promised much worse conditions in the future.

It is significant that the federal standard was established after successful negotiations between environmentalists, who brought a lawsuit against the federal government for its earlier no-standard standard, industry manufacturers, and state representatives. The only state that has attempted to jump those traces so far has been California.

More important than state minimums in promoting the acceptance of higher comfort cooling efficiencies, with their associated higher first costs, have been the many incentive programs launched by summer-peaking electric utilities seeking to postpone the addition of more generating capacity.

They find it less expensive to pay a homeowner or contractor $300 to $600 for installing high-efficiency equipment than to pay up to $1,500 a peak kilowatt for new power plants.

Because of these incentives, homeowners have been revcovering a large portion of the first-cost premium for high-efficiency equipment. In fact, industry shipment statistics indicate that more than a few have been replacing inefficient equipment in good working order so they can lower their operating costs. We estimate that segment as 20% of all replacements, or 200,000 units last year.

Over the past several years, more than 50 electric utilities have been offering incentives of some type. Some have dropped out when they perceived their objectives were met, or when they decided market forces were doing enough of the job for them, but others continue to join.

A utility research group, Applied Economic Research Co., estimates that heightened energy efficiency on all fronts will cut additional U.S. power needs by 20,000 megawatts between now and the year 2000. That's about 12% of projected additional demand, or $60 billion to $80 billion in saved construction costs.

The number of gas utilities offering incentives is much smaller and, for the most part, they have taken the form of no- or low-interest loans for high-efficiency equipment. The fuel oil and LP gas industries, to the best of our knowledge, do not and have not offered any efficiency incentives.

The built environment

The Energy Information Administration's (EIA's) 1984 Housing Characteristics reported that 59.6% of all households, or 51.5 million homes, were equipped with some form of air conditioning in November, 1984.

Of these, 49.9%, or 25.7 million homes, had central air conditioning and 50.1%, or 25.8 million homes, used one or more room air conditioners. Seven of 10 used only one room unit.

EIA estimates that 3.1 million homes in 1984 were equipped with heat pumps, or 12.2% of those with central air conditioning. In 1987, only 6.5% of air conditioned homes used heat pumps.

In addition to central and room air conditioners and heat pumps, EIA reported that 3.8% of U.S. homes use evaporative coolers, 7.8% use whole-house cooling fans, and 35.8% use window or ceiling fans.

Of the 27.1 million natural gas-fired forced-air furnaces installed in U.S. homes, EIA estimates that four of 10 (40.6%) are at least 15 years old.

Other heating equipment, in numbers of installed units and with the percentage at least 15 years old in parentheses, include:

600,000 (78.3%) natural gas-fired gravity furnaces; 3.8 million (61.1%) natural gas floor, wall, and pipeless furnaces; 3 million (58.5%) oil-fired boiler; 3.3 million (49.3%) oil-fired furnaces; 3 million (48.8%) gas-fired boilers; 2.8 million (40.8%) built-in electric heating systems; 900,000 (40.1%) LP gas-fired room heaters; 3 million (33%) natural gas-fired room heaters; 1.2 million (33%) LP gas-fired furnaces; 2.5 million (12.9%) electric furnaces; 2.3 million (9.8%) heat pumps; and 5.2 million (9%) wood stoves.

Natural gas accounted for 55.4% of all principal heating systems in 1984. These included warm air furnaces (33.9%); hydronic systems (10.1%); floor, wall, or pipeless furnaces (6.5%); and other systems (including room heaters (4.95%).

Electricity accounted for 16.8% of all systems. These included built-in systems (6.3%); electric warm air furnaces (6%); heat pumps (3.6%); and other (0.9%). Fuel oil accounted for a 12.4% share. These included hydronic systems (7.3%), warm air furnaces (4.7%), and other oil-fired equipment (0.5%).

Wood accounted for 7.5% of principal heating systems, including 6.6% which were wood stoves and 0.9% other systems. LP gas accounted for a 4.5% share. These included warm air furnaces (2.7%); room heaters (1.2%); and other types (0.7%). Kerosene heaters accounted for 1.7% of principal heating systems.

More than four of 10 (41.1%) of existing homes in 1984 used a secondary fuel source. Principal among these were wood (20.1%), electricity (14.1%), and fuel oil or kerosene (7.1%).

Energy use

EIA also collects detailed information on average energy use for heating, cooling, domestic hot water heating, and appliance use. The latest report,

Each Statistical Panorama includes the latest data available. Sources frequently revise their previous year's figures, which explains apparent discrepancies between the latest and earlier published data. Where sources give significantly varying information, that data is mentioned.

covering the period April, 1984, through March, 1985, expresses the usage in millions of Btu.

The average U.S. usage for the period: space heating 59.4 million Btu; air conditioning 4.2 million Btu; water heating 18.8 million Btu; and appliance usage 22.2 million Btu. Expressed in dollars, the U.S. averages were: space heating $427; air conditioning $87; water heating $171; and appliance usage $438.

There were marked regional variations. In the case of heating, for example, it provides average consumption in millions of Btu (with dollar amounts in parentheses) for four regions: Northeast 81.4 million Btu ($646); North Central 86.4 million Btu ($550); South 36.8 million Btu ($288); and West 40.4 million Btu ($275).

In the case of central air conditioning, using the same breakdown, we see the Northeast averaging 5.9 million Btu ($192); North Central 6.7 million Btu ($138); South 5.5 million Btu ($261); and West 7.2 million Btu ($142). For room units: Northeast 2.2 million Btu ($75); North Central 2.3 million Btu ($54); South 1.4 million Btu ($114); and West 2.4 million Btu ($49).

1987 Housing characteristics

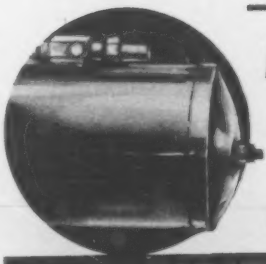
In keeping with our practice of past years, The News has obtained from the Bureau of the Census the characteristics of new homes completed during the last quarter of 1986 and the first three quarters of 1987. The accompanying table on page XXX contains national statistics and, because these figures have an annoying habit of clouding local experience, an added regional breakdown.

It's important to note that these figures are for reported home unit completions and not for home starts, which are reported elsewhere in this issue. The total number of completions, therefore, is not statistically important. The ratios are.

Looking at fuels for single-family homes, the gas share has escalated steadily from 43.4% in 1985 to 46.8% in 1986 to 50.7% last year. Similarly, oil's share has risen from 2.6% in 1985 to 4.1% in 1986 and 5.2% last year.

Both gains came largely from electricity, which declined from 49.9% in 1985 to 45.6% in 1986 and 40.6% last year. Other fuels also declined from 4.1% in 1985 to 3.6% in 1986 to 3.5% last year.

Much the same story is true for mul-



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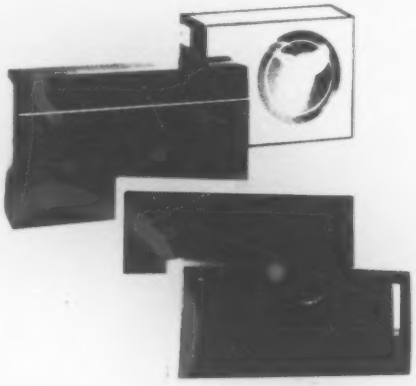

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tifamily completions. The gas share escalated from from 30.2% in 1985 to 33.4% in 1986 to 39.7% last year. The electricity share declined from 68.7% in 1985 to 64.5% in 1986 to 57.5% last year. Oil rose from 0.2% of multifamily completions in 1985 to 1.3% in 1986 only to fall back to 1% last year.

This shift, we believe is a result of both geography and fuel price changes. New home markets in the Northeast, stronghold of oil heat, and the North Central region, stronghold of natural gas, have been vigorous over the past two years. New home sales in the South, stronghold of the heat pump and electric resistance heating, have languished during the same period.

At the same time, the sharp decline in fuel oil prices since late 1985 has translated directly into market share increases for this fuel even though the base is small. The use of other fuels, which include wood, LP gas, kerosene, coal, and solar peaked more than two years ago. Today, they are on their way downward in terms of new construction.

The penetration of central air conditioning in single-family homes completed in 1987 was 70.6%, up a hair from the 69.9% recorded a year earlier. It has hovered at the 70% level for several years. Air conditioning in multifamily units in 1987 was 87.5%, almost the same as for the two previous years.

Significantly, the penetration of central air conditioning among single-family homes completed in the Northeast continues to increase. It was 41.1% in 1985, increased to 44% in 1986, and last year reached 46.6%. For multifamily units it was 63.6% in 1985, 81.4% in 1986, and 82.3% last year.

In the past year, the North Central region jumped from 61% to 67.5% and the West increased from 49.5% in 1986 to 53.1% in 1987. More than nine of 10 homes built in the South are equipped with central air conditioning.

In addition to comfort cooling increases in areas where past penetration rates have been modest, it should be noted that today's new home market includes a higher-than-normal ratio of large custom homes that almost always include comfort cooling.

Another factor, not displayed in these statistics, is that a growing number of homes are using multiple central units to achieve zoning. This could include 11% of all homes built in 1986 and 16% of those built last year. It applies to central air conditioners, heat pumps, and furnaces.

The penetration of heat pumps in single-family homes completed last year slipped again from 29% in 1986 to 27.3%. It had been 30% in 1985. Heat pump penetration in the South, where total completions have dropped significantly, increased from 44.8% in 1986 to 47.8% last year while penetration in the other three regions dropped a bit.

The preference for hydronic systems last year increased both nationally and in its Northeast stronghold. Nationally, hydronic penetration increased from 6.3% in 1986 to 7.4% last year — or almost double the 4.3% recorded in 1985. In the Northeast, the hydronics share increased from 33.6% of all single-family home heating systems in 1986 to 37.8% last year.

The warm air furnace share of new single-family homes completed in 1987, at 55.7%, was marginally above the level of the previous two years. It's perhaps noteworthy that warm air furnaces account for only a third of new single-family homes built in the Northeast and less than half of those built in the South. But 86% of those built in the North Central states are equipped with warm air furnaces.

Other studies

In other government studies, The News has learned that, in 1986, heat pumps were installed in 27.7% of the multifamily units completed. Of these, 5.1% were in the Northeast, 6.8% in the North Central states, 63.7% in the South, and 24.4% in the West. In 1982 the heat pump penetration in new multifamily units was 25.7%.

Also in 1986, the penetration of central air conditioning in mobile homes was 48% — 45% in single-wide units and 53% in double-wide units. The rate of penetration ranged from 16% of those shipped to the Northeast, 30% of those in the West, 39% of those in the Midwest, and 58% of those shipped to the South.

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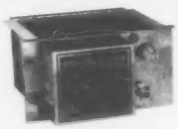

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Circle 8 **Testing the future for the past 90 years**

HOUSING AND CONSTRUCTION

Conventional Housing

Private starts index
Baseline: 1977

Even though total housing starts in 1987 dipped somewhat, it marked the fifth year in a row of reasonably strong homebuilding activity. The total, however, masked continuing regional disparities and sharp differences between single- and multifamily performance.

The Midwest, long the poor stepchild of the housing industry, was the only region to hold its own last year. The Northeast, the bright star in 1986, slipped a bit. The South recorded its fourth decline in as many years and the West, like the South, dropped at a rate greater than the national average.

1987 experience

The strength of the single-family market continues to show itself, although its composition is changing. The trend clearly favors up-scale buyers and would-be first-time home buyers are finding it tougher and tougher. In the multifamily segment, almost all of the drop has come in the seriously overbuilt rental segment. Its a situation that's likely to persist for the next several years.

Private housing starts in 1987, at 1,617,100 units, declined by 10.5% from the 1,805,400-unit total for the previous year. The 1986 total was the 1980's high-water mark.

There were sharp regional differences.

In the Midwest, where restructuring of manufacturing and export market increases are starting to pay dividends, total housing starts last year — at 295,800 units, or 18.3% of the total — were virtually identical with the previous year.

Housing starts in the Northeast, where a short supply of serviced land has kept the supply down and prices up, totaled 269,000 in 1987, down 8.4% from the previous year's total of 293,500 units. Its 16.6% share of the total housing market remains the same. A 4% unemployment rate and net migration gains promise continued strength.

The South, which as late as 1983 enjoyed a 56% share of the national housing market, experienced its fourth decline in a row in 1987. Although still the largest market, housing starts last year, at 632,200 units, were down 13.8% from the 733,100-unit total in 1986. Its share of the national market slipped again to 39.1%, the lowest since 1977. Although much uncertainty remains, the partial recovery of the oil industry indicates the South may be near the bottom of the demand curve.

Housing starts in the West, where California defense spending is moderating and other states are experiencing a weakness in natural resource industries, totaled 420,000 units in 1987, down 13% from the previous year's total of 483,000 units. Its share of the national market dropped fractionally to 26%.

Single-family home starts in 1987 totaled 1,143,700 units, a drop of only 3% from the previous-year total of 1,179,400 units. It was the fifth year in a row when this sector topped the one million mark. The totals include an ever-increasing number of up-scale custom homes — a trend that favors the hvac industry but makes it more and more difficult for first-time homebuyers.

The multifamily home start total for

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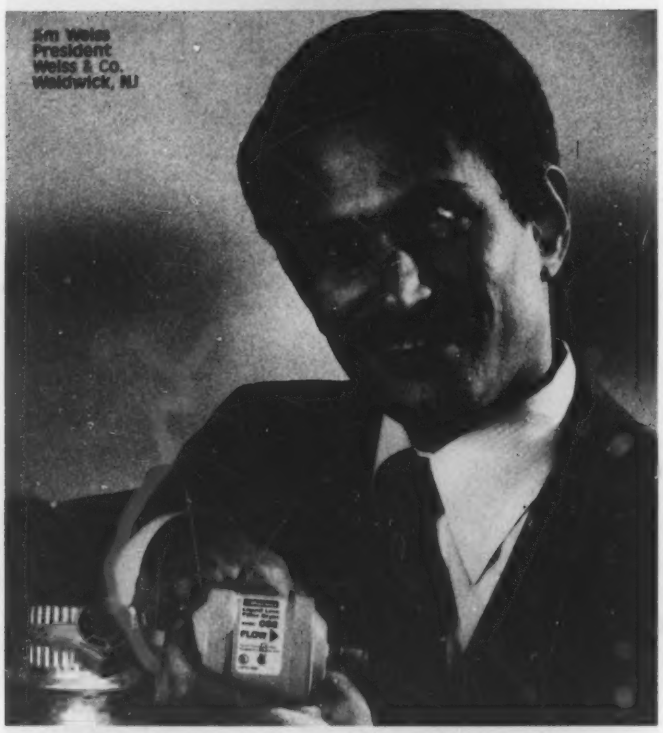

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HOUSING AND CONSTRUCTION

1987, at 473,400 units, was down 24.5% from the 627,300-unit total for the previous year. Although the for-sale condominium segment stayed almost the same, the sharp decline in rental apartment construction — which in the past has accounted for 70% of this segment — brought the total down.

1988 forecast

Single-family home construction in 1988 will again be the cornerstone of the new home market. Despite continued regional disparities, this segment should record its sixth year in a row above the one million mark.

A major key, of course, is interest rates. But in another year of slow growth in the economy, coupled with the impetus of the November elections, interest rates are not likely to increase by much. The market will be led by middle-aged up-scale buyers.

The Northeast, which has been hampered more by land scarcity and rapidly escalating prices than by lack of demand, should hold its own this year. The Midwest, which held its own last year, should slip a bit in 1988 because demand in some of the major urban markets already is softening.

In the South, there are signs that both the energy and agricultural industries are turning around. However, it may be 1990 before these developments translate into significant homebuilding increases. In the meantime, look for more modest declines over the next two years. The bright spot is the South Atlantic region.

The strength of the California defense industry, which has propped up the West for several years, is beginning to wane. Even though the computer-related and agricultural industies are improving, they cannot make up for defense losses and continued weakness in the Mountain states natural resources industries. Look for moderate declines through 1989.

On balance, then, single-family home starts this year should hold almost even. We're forecasting a 1.6% drop to 1,125,000 units.

The multifar. ily market presents a sharp contrast. The boom in rental apartment construction in 1984 and 1985 was partly artificial. It was fueled by the availability of tax-exempt bonds and tax shelter-oriented syndicates with a commitment to build whether or not there was any demand. The new

tax law wrecked the base on which these financing arrangements were built.

These developments, coupled with a sharp decline in oil-related employment, resulted in a serious oversupply of rental apartments and a national vacancy rate last year of more than 8%. It ranged from 4.1% in the Northeast to 11.2% in the South. In fact, the excess vacancies already built exceeds more than two years of normal new-unit production.

Added to the gloom surrounding the new rental apartment market is the fact that, about the time two or three years from now that the surplus is worked off, demographic studies indicate the demand for rental apartments will be in decline.

On the brighter side, both the Northeast and Midwest do not have serious overbuilt problems. The notoriously volatile condominium market made up of vacation and retirement housing, as well as housing for young urban professionals, has remained relatively stable. This market is being supplemented, particularly in the Northeast, by first-home buyers as an affordable alternative to single-family units.

On balance, then, we believe multifamily home starts in 1988 will total about 400,000 units, down 15.5% from last year's total.

Taken together, private housing starts in 1988 should total 1,525,000 units, down 5.7% from the 1,617,100-unit total in 1987. Even so, another year with single-family starts above one million cannot be regarded as bad. Just as importantly, this market promises to continue at that level through the end of the decade.

For the record, the National Association of Home Builders (NAHB) forecasts 1988 housing starts will total 1,490,000 units (1,056,000 single-family, 434,000 multifamily). NAHB forecasts a 1,430,000-unit total (1,019,000 single-family, 411,000 multifamily) for 1989 and 1,540,000 units (1,102,000 single-family, 438,000 multifamily) for 1990.

The top 20

Home construction in the top 20 metropolitan areas for the first eight months of 1987 had a different complexion than a similar list of only a few years ago. Cities in the Northeast and Midwest have cracked the list and others, particularly in the South, have dropped away.

For example, the Dallas-Fort Worth market was in first place as late as 1984. It slipped to eighth in 1986 and, last year, failed to make the top 20. Houston, another former leader, dropped from the list a year earlier.

The leaders through the first eight months of 1987, with the total residential permit totals in parentheses, follow:

Los Angeles-Long Beach (38,140); Atlanta (30,420); Washington, D.C. (30,210); Riverside-San Bernadino, Calif. (26,320); San Diego, Calif. (19,150); Chicago (19,150); Anaheim-Santa Ana, Calif. (19,050); Phoenix (18,550); Minneapolis-St. Paul (17,980); Tampa-St. Petersburg, Fla. (16,610); Detroit (15,860); Philadelphia (15,800); West Palm Beach-Boca Raton, Fla. (14,610); Seattle, Wash. (14,460); Fort Lauderdale-Hollywood, Fla. (13,800); New York (13,500); Oakland, Calif. (13,280); Baltimore (12,720); St. Louis (12,480); and Orlando, Fla. (12,330).

Affordability

Interest rates, a crucial element in homeownership affordability, dipped to 9.04% in March, 1987, for a fixed-rate 30-year mortgage. They climbed gradually to 11.26% in October and, following the stock market downturn, finished the year at 10.65%, according to the Federal Home Loan Mortgage Corp. survey of major lenders.

Adjustable rate mortgages (ARM's), which bottomed at 8.36% in April, 1987, climbed to 9% in October and then dropped slightly to 8.94% at year's end. They cover terms of 15 years and longer and down payments of 25%.

Although still much higher than they might be were it not for the federal deficit, home mortgage rates are considerably lower than the peak in 1981 when 30-year fixed mortgages went for 16.64%. The ARM's came into play in 1984 and, in that year, captured 61% of the home mortgage market. It was 50% in 1985, 31% in 1986, and turned upward to 43% last year with the increase in fixed-rate mortgage costs. ARM's had a 60% market share last October.

Mortgage rates play an important role in determining the potential number of new home buyers. For example, a family buying an $85,000 home today with a 10% down payment and a 30-year fixed rate mortgage at 11%., would need an income of $36,586 to qualify. That would encompass 16.8

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million families, or 27.1% of all families.

Monthly carrying cost, including principal, interest, taxes, and insurance, would be $854. If the interest rate were 17%, its peak only seven years ago, monthly payments would be $1,219. Only 7 million families, or 11.4% of the total, would have the required $52,222 annual income to qualify. Similarly, 35.2% of all families would have the $31,744 annual income to qualify if mortage rates were at 9%.

Remortgages to take advantage of the lower rates accounted for about 45% of all mortgages in 1986 but, after the first quarter of 1987, fell off steeply. The amount of mortgage money available has not been a problem for several years. The national mortgage delinquency rate fell to 5.09% in the second quarter of 1987, the lowest level in more than six years.

Renters typically have lower incomes than homeowners. In recent years that gap has widened. The median income for renters was 65% that of homeowners in 1970 and, by 1983, it had decreased to 49%. Renter households also are smaller. In 1983, a third of all renting households consisted of one person and nearly two thirds consisted of no more than two people.

According to the Federal Home Loan Bank Board, the average price of new and existing homes sold in the third quarter of 1987 ranged from $191,200 in New York City, $183,900 in Boston, and $179,400 in San Francisco, to $79,700 in Pittsburgh, $83,600 in Louisville, Ky., and $89,400 in Columbus, Ohio. The average for 32 major cities was $123,700, up 5.7% from the same time a year earlier.

The volume of new home sales in 1987 was 680,000 units, down 9.3% from the 750,000 total a year earlier. NAHB also reported that the sale of existing homes, at 3,550,000 last year, was down 0.7% from the total of 3,565,000 homes sold in 1986.

The typical home buyer in the third quarter of 1987 was a 39.5-year-old trade-up buyer with a wife, children, and a median family income of $44,823. They paid a median $95,982 for a median 1,750 sq ft home on a 10,000 sq ft lot that cost a median $24,271. The median mortgage was $81,875 and the odds favored a conventional fixed-rate mortgage and a two-income family.

Home ownership rates, which climbed steadily from 43.6% in 1940 to a peak of 65.8% in the third quarter of 1980, slid to 63.8% early last year. In the third quarter, however, it had climbed back to 64.2%. The recent trend toward declining home ownership has been most apparent among young households.

In areas other than the east and west coasts, single-family homes are likely to continue to be the normal expectation of most homebuyers, according to NAHB.

In the Northeast, however, townhouses (including duplexes and attached row houses) account for a large share of single-family starts. In 1986, for example, the region accounted for

Housing plummets in the 'oil patch'

The "oil patch" states of Texas, Oklahoma, and Louisiana still are mired in a recession. The economic downturn has hurt virtually all segments of the states' economies, not least housing.

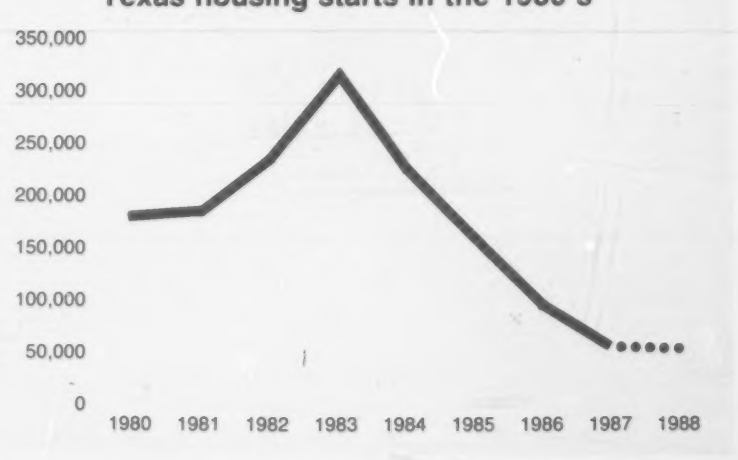
Dallas contractor Fred Kahn takes some cold comfort from the belief that the Texas economy had finally hit bottom. "At least we know where the bottom is," he said.

Result: Many bankruptcies among contractors, much overcrowding among survivors.

Here is a look at housing construction in the three states for the 1980's.

Texas, as recently as 1983, saw more than 300,000 housing units built. That performance gave it 19% of the nation's housing. But last year, only 55,000 housing units were built in the state. The forecast for 1988 is 51,000 units. Only 5,200 multifamily units are forecast for 1988.

No city in Texas is immune, but much of this housing deficit comes from the Houston market, which a mere decade ago was throwing up



60,000 units. The city will be lucky to build 9,000 units this year. Dallas, which built 112,000 units in 1983, finished last year with 26,300. San Antonio and Austin are similarly hard hit.

Oklahoma and Louisiana show a similar pattern. At its high point in 1983, Oklahoma built more than 50,000 homes. Last year and this, the total will be about 8,900. Last year, only 900 multifamily units were built

19.3% of the nation's single-family starts but 39.2% of the nation's townhouse starts.

The concentration reflects high land costs, strong demand, cultural tradition, and land use regulations. Most of the townhouses in the Northeast are built as for-sale condominiums. In most other parts of the country they are sold on a fee-simple basis.

In California land costs are as high or higher than those in the Northeast but the regulatory attitude is different. Detached "patio homes" are built at densities of 10 per acre but, according to NAHB, if land prices continue to escalate in that region, attached townhouses will increase.

At present there are between 4 million and 5 million second homes in the U.S., including more than 500,000 mobile homes, according to NAHB. The trade association predicts a second-home construction rate of between 100,000 and 125,000 units a year for the next several years. This is a substantial increase over the 65,000 annual rate in 1980.

Ownership of second homes is concentrated among middle-aged married couples. The latest surge springs from the so-called baby boomers who are reaching middle age in increasing numbers.

Demographics

Households will grow at a rate of about 1.4 million to 1.5 million a year for the next three years, according to figures supplied be the Bureau of the Census. This is slightly higher than in the period 1980 through 1983 but about the same as in the years since 1983. There will be a steady decline after 1990 because of the baby bust in the 1963 through 1973 period.

Although this means a significant decline in the young adult market, it also means a strong expansion among those in their middle years — who have more discretionary income. The highest growth categories over the next few years will be young singles and married couples aged 35 to 44 and singles over 75 years. Declines will be among married couples 18 to 29 years and 55 to 64 years.

Despite the temporary problems in the oil industry, the Sunbelt will show more rapid future growth than the Snowbelt over the long term. As a nation, the U.S. is experiencing a significant decline in the mobility of the workforce. It's partly an outgrowth of the increase in two-earner households.

Since the 1982 recession, regional economic growth patterns have undergone a dramatic change.

High technology defense and commercial products, financial and communications activities have concentrated in the Northeast and West Coast. Major activities in the industrial heartland weakened. The energy producing states fared badly when the world price of oil collapsed and the farm belt suffered when world commodity prices dropped.

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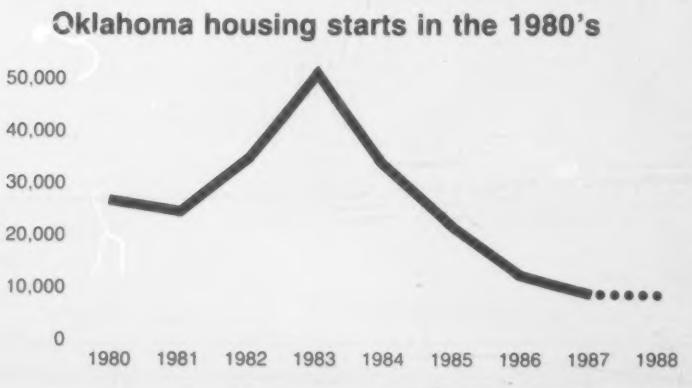


in the Sooner State.

Louisiana's woes are similar. After decades of putting up 20,000 and 30,000 homes each year, Louisiana dropped to 8,900 last year.

Add it all up and the three-state intake of central air conditioners and heat pumps for new homes has plunged by several hundred thousand units. Only the replacement business for this mature air conditioning market has kept contractors alive.

But that, too, is changing. In the period 1988 through 1992 U.S. manufacturing will become more competitive. The Great Lakes states already are seeing some of those benefits as exports of manufactured goods expand. The lower value of the dollar in world markets also has improved the prospects for agriculture. Oil prices, although still potentially volatile, are increasing slowly.

The lower value of the dollar compared to some major currencies also means that the Japanese and other foreign nationals will soon be moving into the U.S. home construction market, according to NAHB. It's just too attractive an opportunity to pass up.

Meanwhile, the renovation market is burgeoning. It bumped along at less than $50 billion prior to 1983. But in 1984 it was $69 billion, in 1985 it was $80 billion, in 1986 it was $91 billion, and last year it topped $96 billion. It should total $100 billion this year.

Mobile homes

Shipments of mobile or manufactured homes in 1987 totaled 232,598 units, a decrease of 4.9% from the 244,600 mobile homes shipped in the previous year, according to the Manufactured Housing Institute (MHI).

Shipments of these site-delivered homes, popular with retired people and those with moderate incomes, are not counted in the official housing statistics.

For the past two years mobile homes have amounted to 20% of private single-family site-built homes, down from 26.6% in 1985. They compare to 36% in recession-ridden 1982.

The South Atlantic, with 37.6%, and the South Central region, at 20.3%, were the leading mobile home markets in 1987. The East North Central region, at 12.4% of total mobile homes shipped, was a distant third.

The product mix in 1987 was 59.8% single-section homes and 40.2% multisection units, according to MHI. The 1986 split was 62.7%-37.3% in favor of single-section homes.

MHI president Jerry C. Connors said MHI was upset that the U.S. Department of Housing and Urban Development planned to turn over development and maintenance of the Federal Manufactured Home Construction and Safety Standard to the Council of American Building Officials (CABO).

He said HUD now plans to retain authority over the standard and promises equal consideration to revisions proposed by other groups. With this in mind, MHI is forming a Consensus Committee of producers, users, and general interest groups to develop new standards proposals.

Among issues already identified which will be considered at the committee's first meeting June 1 in Atlanta will be revisions to the energy standards.

REPLACEMENT MARKET

Replacements are the glue that holds individual markets together in hard times. They keep increases within reason when new construction booms. The stability of this market is the best single antidote for the often violent variations in the new building market.

In 1987, for example, shipments of residential heating and cooling equipment were at or near all-time highs. New home construction, at the same time, declined. The prime reason for the shipment peaks was the increases chalked up quietly by the much less visible replacements.

In fact, the growing importance of replacements has sparked new market approaches by both contractors and manufacturers.

Because service is a prime route to replacement sales, contractors who once regarded service as a necessary nuisance are now putting increasing emphasis on this department. More aggressive contractors are developing marketing plans to uncover additional potential customers who might be tempted to replace equipment for efficiency reasons.

Manufacturers, on the other hand, are revising their marketing stance so they can condition consumers and get close to contractors who are exploiting this replacement market. One is offering contractors free marketing help if they will work with the manufacturer in developing this new potential. Others are urging contractors to consider replacing rather than repairing units only eight years old.

The percentage of replacements within the shipment totals vary widely among product groups. Last year, for example, it ranged from less than 10% for electric furnaces to 86.4% of all oil-fired furnaces shipped. The central air conditioning market, which once depended heavily on the fortunes of the new home market, now depends more heavily on replacements. New homes accounted for little more than a third of home comfort cooling shipments last year.

It's perhaps significant that, in 1987,

the decline of the new home market was more than offset by gains in replacement sales. This was particularly evident among heat pumps, which showed an increase despite drops in both new home segments. We estimate that replacement heat pumps now represent 24% of residential units, up from about 10% only a few years ago.

Renovation expenditures

Before taking a look at individual industry markets, it might be well to look at national total expenditures for alterations and repairs as reported by the Bureau of the Census and the Bureau of Labor Statistics. Their surveys cover 51.3 million owner-occupied housing units and 14.7 million rental properties.

Total expenditures for 1986, the latest full year for which these data are available, amounted to $91.274 billion, up 13.7% from the $80.267 billion total reported for the previous year.

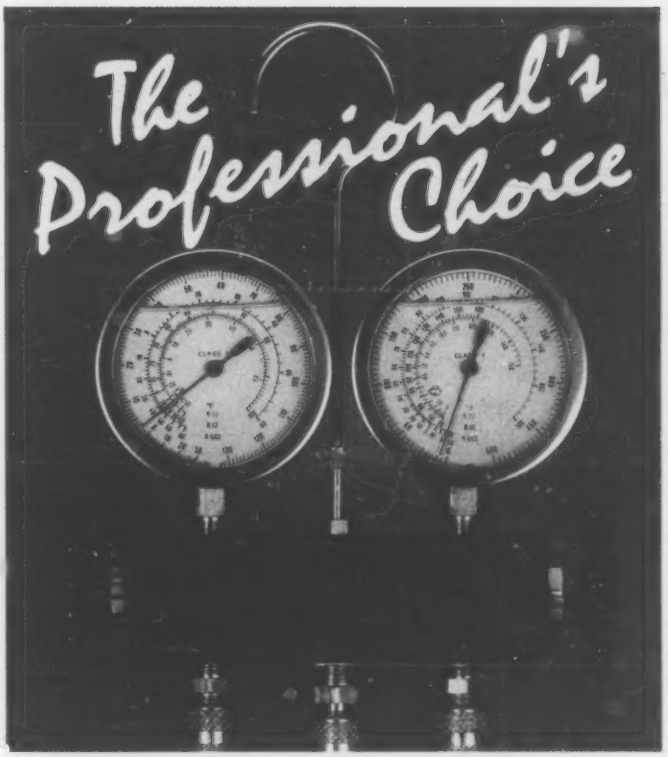
Heating and air conditioning repairs and alterations accounted for 6.8% of the total. That share is up from the 6.35% reported a year earlier, but down from the 7.3% share in 1984. Heating and air conditioning total expenditures, however, increased by 22.3% from $5,096 billion in 1985 to $6,232 billion a year later. The 1982 total was $3.23 billion.

Of the $6.232 billion spent on heating and air conditioning systems in 1986, a total of $3.399 billion — or 54.5% — was spent for major replacements. That's an increase over the previous year of 46.4%. Major replacements include furnaces, boilers, central air conditioners, and heat pumps. The total for 1982, at the bottom of the last recession, was $1.707 billion for major replacements.

The total expenditure for heating and air conditioning alterations and repairs in owner-occupied homes in 1986 was $4.233 billion, up 21.2% from 1985. Major replacements in owner-occupied dwellings in 1986 amounted to $2.261 billion, up 47.3% over the $1.535 billion total a year earlier.

Similarly, the total expenditure for heating and air conditioning alterations and repairs in rental properties in 1986 was $1.999 billion, up 24.6% from 1985. Major replacements in rental properties amounted to $1.138 billion in 1986, up 44.6% from $787 million a year earlier.

In 1986, owner-occupied dwellings accounted for 68% of total expenditures



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Circle 36

Bureau of the Census data

A 10-year look at air conditioning and refrigeration unit shipments

Product	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Condensing units	529,515	537,082	497,833	455,695	439,714	379,787	458,538	440,388	415,666	399,959
Compressors and compressor units	23,991,643	25,790,862	24,970,111	19,829,319	21,233,348	17,433,817	20,690,897	22,774,869	19,738,483	20,043,345
Ammonia compressors	1,443	1,819	2,014	1,860	1,808	1,509	1,173	1,233	1,140	1,123
Screw compressors[1]	—	—	—	5,809	5,320	2,620	3,601	—	—	—
Fancoil units[2]	198,939	186,827	178,719	245,127	253,832	207,232	214,799	209,001	185,263	205,731
Induction units[3]	—	—	—	33,343	—	—	—	—	—	—
Central-station air handlers	52,371	52,441	60,266	60,841	59,866	58,961	56,301	53,413	59,008	61,364
Unitary air conditioners[4]	2,829,447	3,226,998	3,057,009	1,881,465	1,991,507	1,568,838	2,067,152	2,448,677	3,419,063	3,536,580
Unitary heat pumps (air-to-air)	536,558	371,436	646,926	508,457	604,903	408,742	660,956	803,669	865,839	833,614
Water-source heat pumps	—	—	—	69,931	69,689	86,092	69,280	86,165	119,164	103,970
Packaged terminal air conditioners	261,777	148,332	183,274	143,212	143,427	135,741	150,073	184,780	119,123	107,676
Packaged terminal heat pumps[1]	—	—	—	—	32,439	52,512	58,753	93,549	96,155	80,569
Room air conditioners	3,303,335	4,030,423	3,757,102	3,178,993	3,722,509	2,883,156	1,888,075	3,039,491	2,665,825	2,685,552
Centrifugal chillers[5]	2,977	2,975	3,141	4,200	3,938	3,893	4,089	2,289	4,025	3,903
Reciprocating chillers	8,665	9,003	9,695	12,325	12,090	11,668	10,533	13,788	14,064	13,302
Absorption chillers[6]	588	470	392	279	239	199	135	153	131	—
Adsorption, open-type absorption	2,318	2,704	2,503	2,962	3,171	1,461	1,044	1,087	1,087	1,336
Cooling towers[2]	8,517	9,906	—	12,185	15,381	11,222	11,344	10,853	11,063	9,579
Evaporative condensers	2,299	2,453	3,263	2,881	2,859	2,166	2,149	2,426	2,505	2,282
Mobile vehicle air conditioners	9,459,535	9,074,932	7,651,198	5,852,328	6,059,342	5,651,329	9,267,612	12,196,385	13,008,516	—
Mobile air conditioners for trucks, agricultural, construction equipment[3]	2,452,820	1,298,198	1,352,198	764,942	834,174	1,064,381	1,557,060	1,948,655	2,154,467	
Mobile vehicle refrigeration systems[3,6]	76,536	70,731	76,395	60,301	66,773	68,843	66,502	36,548	44,916	—
Recreational vehicle air conditioners[1]	—	—	—	93,919	119,566	142,227	156,689	173,914	172,833	151,428
Unit coolers[7]	197,975	194,905	187,434	175,371	169,487	163,697	187,612	179,726	205,282	186,357
Ice-making machines	165,106	194,049	218,827	166,725	165,626	150,475	166,399	218,281	201,668	202,446
Drinking water coolers	335,173	373,885	411,687	409,782	432,733	373,560	429,258	528,043	564,743	595,386
Dehumidifiers	351,188	477,692	728,148	734,738	540,386	438,833	610,013	586,003	589,056	606,803
Humidifiers (central and self-contained)[1]	—	—	—	423,986	396,413	310,342	324,948	427,504	370,585	410,762

Source: Bureau of the Census Current Industrial Reports MA-35M, Air-Conditioning and Refrigeration Equipment, including Warm Air Furnaces. [1]New category since 1980. [2]Excludes vertical stack units in 1977. [3]Withheld to avoid disclosing operations of individual companies. [4]For years 1980 through 1984, add these figures to those for unitary heat pumps (air-to-air) and subtract exports to get comparable industry figures. [5]Excludes open-type units for 1978 and succeeding years. Also excludes units 200 hp and under and units 401 to 500 hp. [6]Excludes railway freight cars for 1978 and succeeding years. [7]Excludes floor-mounted dry and spray types for 1979 and succeeding years. [8]Grouped with adsorption, open-type absorption, in 1986.

for heating and air conditioning alterations and repairs and 66.5% of major replacement expenditures. By the same token, rental properties accounted for 32% of total expenditures and 33.5% of major replacements.

The National Association of Home Builders (NAHB) estimates that the 1987 home renovation market topped $96 billion and, this year, will cross the $100 billion threshold. In 1982 it was only $45.2 billion.

There are many reasons for the surge in home renovations. The most obvious is that the nation's housing stock now numbers more than 100 million. The huge numbers of homes built in the late 1940's and up through the 1960's, as well as many homes built prior to World War II, are being substantially updated.

Some of the factors that suggest even more expansion of this market include the trade-up desires of middle-aged baby boomers, especially in areas where home prices have escalated sharply.

Many of those who trade up to existing homes, especially two-worker households with few or no children, often want to significantly update their purchase. A study conducted by the Joint Center of Housing Studies at Harvard-MIT has shown that more than 50% of renovation expenditures take place within five years of purchase. Existing home sales for the past two years have been at a high (3.5 million a year) rate.

The Harvard-MIT study also noted that 40% of home sellers spent an average of $1,265 to fix up their homes prior to selling them. Most of that expenditure, however, was thought to be for repairs rather than improvements.

These demographic factors have been reinforced by the ready availability of financing through second mortgages and home equity loans. The renovation market in recent years also has been helped by the shift in housing activity to the Northeast and Midwest.

Air conditioning

It should also be noted that 88% of all major replacements in owner-occupied single-family homes were handled by contractors. Only about one in 10 major replacements are handled by the homeowner and, in 1.2% of the cases, the homeowner bought the materials that were installed by a contractor.

For easier understanding and better accuracy, the replacement market for

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unitary air conditioning should be separated into four parts — residential and commercial comfort cooling and residential and commercial heat pumps. For example, the unitary residential replacement share last year was 37.7% of shipments. But two components of that share, comfort cooling at 42% and heat pumps at 24%, were quite different.

If we subtract 918,432 heat pumps from the 3,955,064-unit 1987 unitary total, we get 3,036,632 comfort cooling units — of which 82.4% or 2,502,185 were residential units and 17.6% or 534,447 were commercial units.

This split was selected because it matched the determination of the Air-Conditioning and Refrigeration Institute (ARI) for 1986, the latest year for which this split was available. The ratio was the same for the years 1985 and 1986. (If you're comparing this split with the one found in "Air Conditioning," remember that this one does not include heat pumps.)

Of the 2,502,185 residential cooling units shipped in 1987, we estimate that 856,500 (34.2%) went into new construction (577,100 into new single-family homes and 279,400 into multifamily units). These figures are arrived at by multiplying the known penetration rates for central air conditioning by the known number of housing starts and subtracting the known number of heat pumps.

The new single-family air conditioning totals were increased this year to reflect the extra units going into large custom homes. Many of these homes use multiple units to achieve zoning. To reflect this phenomenon, we've added 16% to the single-family penetration totals for both comfort cooling and heat pumps. A distortion in 1987 was the 182,600 comfort cooling units (7.3% of the total) added to factory and field inventories.

Looking back at the revised total of 910,600 comfort cooling units we estimated were installed in new homes in 1986, we can see that this market segment declined by almost 6% last year. The decline was even more steep in the heat pump segment of the market.

The other residential cooling units shipped in 1987 break down this way: 1,010,000 units (40.4% of the total) were single- and multifamily replacement units, up 26% from the revised 798,800 units (36.3% of the total) in 1986; 300,200 (12%) were add-ons, up from 264,200 in 1986; 113,300 units (4.5%) went into new mobile homes, down from 117,400 in 1986; and 39,600 units (1.6%) were mobile home replacements, down from 41,100 units the previous year.

Although there is growing evidence that utility rebates for high-efficiency equipment have leveled off, they still exert a strong driving force in the marketplace. Most of the increase in the replacement market in 1987, however, was attributable to the successive heat waves that rolled over the Midwest and Northeast during early summer.

It must be remembered, too, that central air conditioners have already been installed in more than 30 million U.S. homes. Of these, more than a million each year cross into the 12- to 15-year-old prime replacement category.

Contractors and manufacturers alike are fast changing their marketing methods to get their share of this fast-growing replacement market. For contractors, this means more emphasis on service and the development of more sophisticated marketing plans. For manufacturers, it means forging closer alliances with merchandising and service-oriented contractors.

Not to be forgotten is the growing number of homeowners who are replacing equipment in good working order for reasons of efficiency. Some estimate that this phenomenon, already well developed in the heating segment, now accounts for 20% of replacement sales.

Looking ahead, growth in replacements is assured by the steadily mounting number of units passing the 12-year-old threshold. They should approach 2 million units a year by the end of the decade and lead total unitary shipments across the 4 million mark soon after. Meanwhile, the new home market probably will remain relatively flat.

Commercial

Of the estimated 556,800 commercial unitary comfort cooling units shipped last year, we estimate that about 334,000 units, or 60%, went into new construction and 222,800 units, or 40%, were replacements. The total of 556,800 commercial air conditioning units shipped in 1987 represents an 13.2% increase over the revised total of 491,700 units shipped in 1986.

It should be noted that we have discovered no reliable way to accurately estimate the division between new and replacement commercial units. New commercial construction totals, expressed in millions of square feet, and the ARI ratios are but rough guides.

Judging from the slight decline in light commercial construction last year, however, it would appear that commercial replacements are holding their own with their residential counterparts and, again, represent a growing future potential.

Heat pumps

In the case of the 779,100 residential heat pumps we estimate were shipped last year (85% of total shipments amounting to 918,432 units), it would appear that 497,300 of these (63.8%) went into new homes. Of these, we estimate that 364,800 went into single-family homes and 132,500 heat pumps went into multifamily dwellings.

This represents a 10.4% decline from the 555,200 heat pumps we estimated were installed in new single- and multifamily homes in 1986. The decline is quite respectable in the light of an additional slight decline in single-family home heat pump penetration and the 24% slide in multifamily starts last year.

Of the remaining residential heat pumps, we estimate that 30,000, or 3.9%, were add-on units, 15,000, or 1.9%, went into mobile or manufactured homes, and 188,600 heat pumps, or 24.2%, were replacements. The remaining 48,200 heat pumps, or 6.2% of shipments, represented the net increase in factory and field inventories.

The 119% increase in residential heat pump replacements last year over the 86,100-unit total in 1986 was, we believe, due to a combination of factors. Weather probably was the least of these. The summer of 1987 in the South and West was relatively cool.

With new home starts down substantially, contractors in the South are concentrating heavily on replacement sales. This drive has been helped by the fact that today's residential heat pumps are much more efficient across the board than those of even five years ago. In fact, they now rival the efficiencies of straight cooling units.

Another factor, although much less important to the overall result, is a growing trend among some contractors to replace split-system air conditioners with heat pumps on home furnaces. In some areas the utility rebates make it possible to accomplish this for a few hundred dollars extra. The homeowner

benefits by being able to use the heat pump for heating during the milder spring and fall seasons.

In terms of commercial heat pumps, we believe that 111,400 units, or 80% of the 139,300-unit total, went into new installations and only 20%, or 27,900 units, were replacements. The total represents a 3.9% increase over the 134,100 commercial heat pumps we estimated were shipped in 1986.

The add-on market for residential comfort cooling, fed by the desire of homeowners for the comfort of central air conditioning without the need to buy another home, once led replacements by a wide margin. But, as the market matured, the number of add-on units diminished.

For example, as late as 1981, add-ons had an estimated 29% market share. We believe that share had dropped to about 12% by 1986 and stayed constant at that level last year. Even so, it accounted for 300,200 comfort cooling and 30,000 heat pumps last year.

In future years we expect the add-on market will grow a bit during years when new home construction is down and slack off a bit when the new home market picks up. A small but growing influence has been the trend to replace old furnaces for the sake of efficiency. We suspect that many homeowners who did not have central cooling elected to add it when they replaced the aging heating plant.

Boilers

Of the 356,460 residential boilers shipped last year, we estimate that only 84,600 of them went into new single-family homes. When about 6,000 boilers for new multifamily homes are added, the total comes to 90,600 units, or 25.4% of total shipments.

The other 265,860 boilers, or 74.6% of the total, were replacements. The ratio of replacements until recently has been more than four of every five shipped. It has slipped in the past two years because total shipments have increased and new home penetration, particularly in the Northeast, also has increased.

In passing, it might be noted that the gas conversion phenomenon, which distorted residential gas boiler shipments at the turn of the decade, is long over. Today's market is on a more normal footing and oil-fired units have regained much of the ground they lost in the conversion war.

Furnaces

Of the 205,445 residential oil-fired furnaces shipped last year, we estimate that 28,000 of them, or 13.6% went into new single- and multifamily homes. This means that 178,300 of them, or 86.4%, were replacements.

Although the percentage is not large, the 28,000 furnaces installed in new homes last year represents a 38.3% increase over the 20,250 furnaces installed in new homes in the previous year. The 1986 total, in turn, represented a 66% increase from 1985.

The shift is explained by the sudden drop in oil prices in late 1985 and the relatively high cost of both natural gas and electricity in oil's major market, the Northeast.

Not to be forgotten, either, should be the 237,000 replacement oil burners shipped in 1987, according to Fuel Oil/Oil Heat magazine. The publication's editors reported that virtually all of these were retention-head or other high-efficiency types.

Of the 2,072,925 residential gas furnaces shipped in 1987, we estimate that 831,400 units, or 40%, went into new single- and multifamily homes. This includes 118,000 gas furnaces installed in new mobile or manufactured homes.

The remaining 1,241,525 gas furnaces, or 60% of the total, were replacements. It should be noted that, of the 27.1 million gas-fired furnaces the Department of Energy (DOE) estimated were installed in U.S. homes in 1984, about 40% — or 10.8 million gas furnaces — are at least 15 years old.

Efficiency

Actions by homeowners anxious to control their fuel bills have resulted in an additional market segment since the early 1980's — a market that involves the replacement of inefficient equipment in good working order for the sake of efficiency.

For example, the inefficient (below 65% annual fuel utilization efficiency or AFUE) atmospheric gas furnaces that represented almost the whole market at the beginning of this decade had shrunk to an 11% market share in 1987 (see "Comfort in Construction").

At the other end of the spectrum, 684,602 gas furnaces shipped in 1987, or 33% of the total, had AFUE's of 80% or more. Most of these were replacements.

Similarly, the Gas Appliance Manufacturers Association (GAMA) also reported that 114,384 oil-fired furnaces shipped in 1987, or 55.4% of the total, had AFUE's of 80% or more. Only 10,871 oil furnaces shipped, or 5.3% of the total, had AFUE's of less than 75%.

This efficiency market, while substantial, has stabilized at just over 30% for the past four years. The high end of that market, however, has increased slowly but steadily from 11.1% in 1984 to 16.1% last year.

It is enough, perhaps, that these efficiency markets have not deteriorated in the face of substantial oil price cuts since late 1985, minor natural gas price drops in some areas, and only modest electricity price increases. This market segment will, of course, take a quantum leap when federal mandatory minimums take effect in the 1989 through 1992 period.

The efficiency market for comfort cooling and heat pumps is another matter. Electric rates already are high and, while no major increases are likely in the near future, they continue to attract attention from homeowners. This is particularly true in the South, where many utilities have imposed seasonal or time-of-day penalties in order to reduce peak loads.

Homeowners have reacted in two ways. They are buying more efficient air conditioners and heat pumps and they are using them less. This trend probably would continue even if the utilities were to withdraw their efficiency incentive programs.

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INTERNATIONAL

There was a time, not long ago, when the United States air conditioning and refrigeration industry could boast of a whopping positive trade balance. It reached almost $1.8 billion in 1981. In 1987, despite a healthy increase in exports, it had dwindled to $285 million.

More than half of the imports last year were included in only two categories — $528 million worth of compressors and $152 million worth of room air conditioners.

Imports have more than doubled in the last four years. In 1985 only 35,951 room units were imported into the U.S. Last year, helped by U.S. oem's (original equipment manufacturers) who moved production offshore, 697,446 room units were imported — or 18.4% of domestic production.

The balance of trade for heating equipment improved marginally by 1.5% last year but, at $85.5 million, it has a long way to go. Even so, heating equipment exports increased by 25.4% last year while imports increased by 12%.

There are many reasons for the continued increases in imports. It should be remembered that, although the value of the U.S. dollar has dropped dramatically against the Japanese yen, the German mark, and the British pound, many other currencies are pegged to the dollar. There has been little change between the relative value of the U.S. dollar and that of Canada, its biggest export customer, for example.

The decline of the dollar against the yen is having an effect but much of it is indirect. Japanese manufacturers accounted for 49% of all U.S. air conditioning and refrigeration imports last year. They make no secret of the fact they are sourcing less expensive components in the world market and building plants in such places as Singapore in order to hold on to American market shares. Honda is shipping auto air conditioning components built in the U.S. back to Japan.

Looking across international markets, the economies of virtually all customer nations continue to expand. The economies of Japan, Korea, and Taiwan are particularly strong, according to The Conference Board. Growth appears to be stalling in Australia.

Although they continue to expand, the economies of West Germany, France, Britain, and Italy show signs of weakening, according to the Board. Canada, too, has shown signs that its expansion is not as strong as it might be.

Trade balance

The total value of U.S. air conditioning and refrigeration exports, according to the Department of Commerce, was $1,615,436,008 in 1987, an increase of 21.4% over the $1,330,977,660 total for the previous year. In 1981, U.S. exports totaled $2.073 billion.

At the same time, the $1,292,395,911 worth of refrigeration and air conditioning equipment imported into the U.S. last year represented an increase of 30.1% over the $993,173,627 total for 1986. In 1981, imports totaled $273.8 million.

Imports represented 80% of exports last year, up from 74.6% last year and from 54.2% in 1985. In 1981, imports represented 13.2% of exports. The biggest single import product category is compressors. Imported compressors totaled 11,467,504 units last year, up 11.7% from 10,268,871 units in 1986.

The positive balance of trade generated by air conditioning and refrigeration equipment was $323,040,097 in 1987, down 4.4% from $337.8 million in the previous year. The positive trade balance in 1981 was $1.799 billion.

It must be remembered that these figures only represent shipments. They do not take into account the profits of U.S. companies from subsidiaries, joint ventures, and from licensing agreements that are not reinvested abroad.

In 1987, for the fifth year in a row, Canada was the leading export market for U.S. air conditioning and refrigeration products. The $556.1 million worth of exports to Canada, or 34% of the total, was up significantly from the

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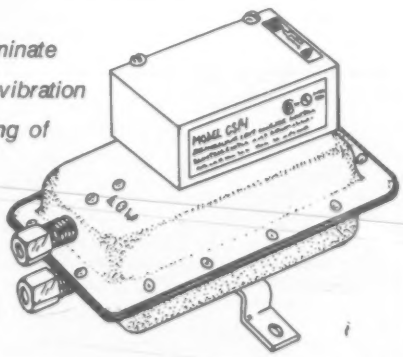

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Major export markets

U.S. air conditioning, refrigeration equipment (values in millions)

Market	— 1983 —		— 1984 —		— 1985 —		— 1986 —		— 1987 —	
	Value	% of total	Value	% of total	Value	% of total	Value	% of total	Value	% of total
Canada	422	27	530	33	534	38	459	34	556	34
Central, South America	180	12	211	13	193	14	234	18	264	16
Western Europe	277	18	290	18	236	16	251	19	287	18
Far East	242	15	247	15	225	16	217	16	297	18
Middle East	361	23	266	17	175	12	140	11	174	11
Africa	51	3	48	3	41	3	28	2	37	2
Other	33	2	11	1	10	1	2	0	0	1
Total	1,566	100	1,603	100	1,414	100	1,331	100	1,615	100

$459 million total a year earlier.

The Middle East, which had been the leading export market for many years, accounted for only 11% of the total, or $173.7 million last year. This market is, however, up from $140 million in 1986.

Although Western Europe slipped from 19% to 18% in terms of total export market share, the dollar amount increased from $235.8 million in 1986 to $287 million last year. Although exports to Central and South America slipped from 18% of the total market in 1986 to 16% last year, the dollar total increased from $234 million to $267 million.

The Far East absorbed $297 million worth of U.S. exports last year, up from $217 million, and in so doing increased its share of U.S. exports from 16% to 18%. Exports to Africa, at $37 million in 1987 were up from $28 million a year earlier but its share of the total export market stayed constant at 2%.

Imports

According to the U.S. Department of Commerce, eight nations accounted for 89% of the $1.292 billion worth of air conditioning and refrigeration equipment and components imported into the U.S. in 1987. The eight:

• **$634.2 million from Japan,** up 15.9% from $547 million in 1986, which mostly included 6.2 million compressors — including 3.3 million auto air conditioning compressors, 1.4 million compressors of less than 0.25 hp, 937,000 compressors of from 0.25 to 1 hp, 560,000 compressors of from 1 to 3 hp, 62,700 room air conditioners, 13,700 heat pumps, 203,300 air conditioning condensing units, $193.5 million worth of auto air conditioning parts, and $12.4 million worth of air conditioning machine parts.

• **$109.9 million from Mexico,** up 69% from $65 million in 1986, which mostly included 16,600 room air conditioners, 305,400 evaporator coils, and 331 commercial refrigeration display cases.

• **$95.7 million from Brazil,** up 43.6% from $66.6 million in 1986, which mostly included 215,100 room air conditioners, 22,600 refrigerators, 1.2 million compressors of less than

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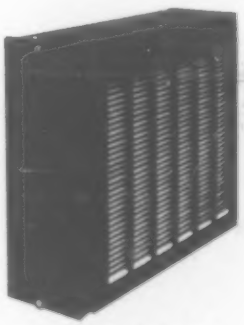

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• **$75.4 million from Canada,** up 17.8% from $64 million in 1986, which mostly included 35,200 refrigerators, 136,000 air conditioners not classified, $10.2 million air conditioning machine parts, $5.5 million other air conditioner parts, 2,650 air conditioner condensing units, 100,000 freezers, and 1,400 refrigerated display cases.

• **$72.2 million from Italy,** down 10.3% from $80.5 million in 1986, which mostly included 1.1 million compressors of less than 0.25 hp, 417,300 compressors of from 0.25 hp to 1 hp, 359,000 compressors of from 1 hp to 3 hp, 3,300 refrigerated display cases, 18,000 freezers, and 4,300 refrigerators.

• **$66.6 million from Singapore,** up 136% from $28.2 million in 1986, which mostly included 131,000 room air conditioners, 862,500 compressors of less than 0.25 hp, and 298,500 compressors of from 0.25 hp to 1 hp.

• **$46.5 million from Sweden,** up 14% from $40.8 million in 1986, which mostly included 98,800 refrigerators.

• **$46.1 million from Korea,** up 281% from $12.1 million in 1986, which mostly included 131,500 room air conditioners, 83,600 dehumidifiers, 50,200 refrigerators, 2,200 refrigerated display cases, 3,800 freezers, 1,500 air conditioning condensing units, and 1,200 heat pumps.

Several other countries, while they didn't make the top eight, had significant imports. West Germany, for example, was displaced by Korea this year but its $30.3 million worth of imports (up 15.7% from $26.2 million a year earlier) included 1,500 refrigerated display cases, 290,700 compressors of from 0.25 hp to 1 hp, 28,300 compressors of less than 0.25 hp, 14,500 refrigerators, and 1,600 air conditioning condensing units.

Other notables included 46,400 dehumidifiers and 333,000 "other" air conditioning machines from Taiwan, 25,300 refrigerators and 22,000 freezers from Yugoslavia, 1,300 refrigerated display cases from Denmark, 97,500 room air conditioners and 21,350 self-contained heat pumps from Malaysia.

Top exports

In terms of products exported from the U.S., the Department of Commerce prepares country-by-country breakdowns for most of the product categories listed in the 10-year look at industry shipments found elsewhere in this issue. In most instances it lists the total number of units shipped to each country and the total dollar value.

Although we do not have space to provide complete breakdowns, a feel for the top export markets of 1987 can be gained by looking at the top customer countries for key products expressed, unless otherwise indicated, in numbers of units. Here are a few:

Auto and truck refrigeration and air conditioning compressors (215,379 units, down 41.2% from 152,494 units in 1986): Mexico 57,479; Canada 28,279; West Germany 27,500; Hong Kong 26,200; France 15,100; Argentina 6,900; Brazil 6,500; and Korea 6,500.

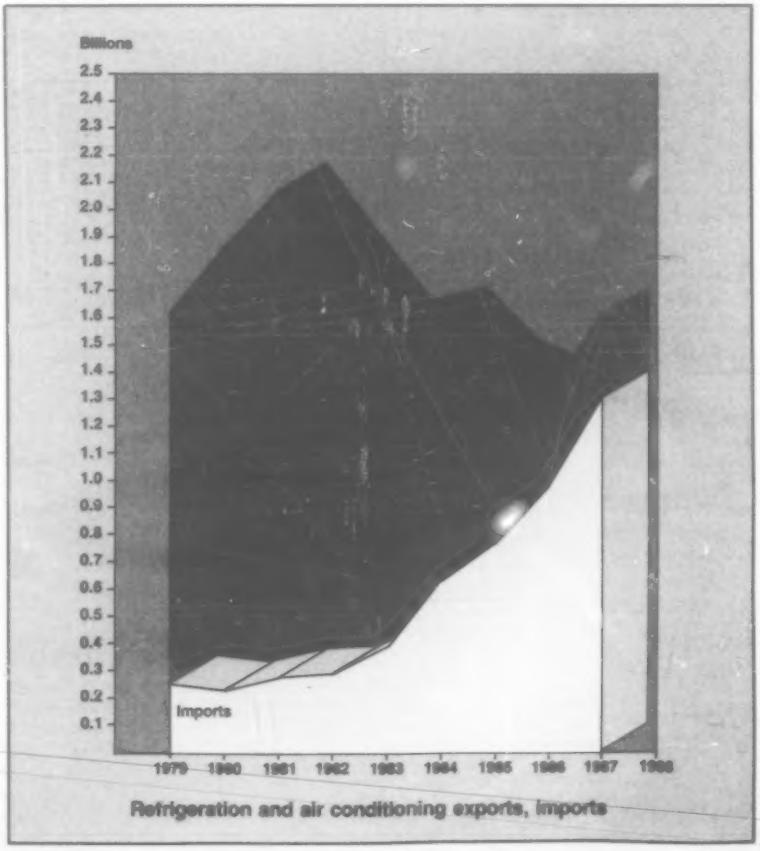
Compressors of 3 hp or less (823,243 units, up 82% from 452,231 units in 1986): Canada 175,056; Saudi Arabia 152,535; Thailand 74,866; Venezuela 50,351; Japan 43,688; Brazil 42,630; France 33,458; Egypt 17,084; Mexico 11,036; and Taiwan 11,036.

Compressors of from 3 hp to 10 hp (142,494 units, up 58.4% from 89,982 units in 1986): Mexico 32,296; Venezuela 17,332; Thailand 14,716; Canada 10,579; Saudi Arabia 6,796; Australia 6,420; Singapore 5,498; and Japan 5,464.

Compressors of more than 10 hp (27,284 units, down 35.6% from 42,392 units in 1986): Venezuela 3,524; France 3,096; Argentina 2,863; Canada 2,476; Britain 2,265; and Australia 2,460.

Ammonia compressors (3,558 units, up 85.6% from 1,887 units in 1986): Canada 1,678; Nigeria 500; Korea 489; Denmark 310; and Mexico 115.

Parts for refrigeration and air conditioning compressors ($45.6 million, up 37.7% from $33.2 million



Refrigeration and air conditioning exports, imports

in 1986): Brazil $9 million; Belgium $6.2 million; Canada $5.6 million; Venezuela $4.2 million; France $2.5 million; Mexico $2 million; Saudi Arabia $1.9 million; and Australia $1.7 million.

Room air conditioners under 10,000 Btuh (19,560 units, up 21.5% from 16,102 units in 1986): Canada 3,617; Taiwan 1,680; Mexico 1,117; Saudi Arabia 988; Netherlands Antilles 917; and Ivory Coast 907.

Room air conditioners of from 10,000 Btuh to 17,000 Btuh (57,785 units, up 90.6% from 30,317 units in 1986): Hong Kong 11,608; Arab Emirates 9,033; Kuwait 8,404; Taiwan 3,682; Mexico 1,635; Ecuador 1,429; Bahrain 1,598; and Pakistan 1,387.

Room air conditioners of more than 17,000 Btuh (34,660 units, up 95% from 17,788 units in 1986): Hong Kong 5,183; Turkey 4,543; West Germany 4,531; Taiwan 3,049; Arab Emirates 1,742; Britain 1,430; Canada 1,354; Mexico 1,038; and Sudan 1,008.

Self-contained heat pumps of 5 tons and under (14,918 units, up 11.2% from 13,413 units in 1986): Canada 11,437; Mexico 453; Britain 416; and Bahamas 369.

Self-contained heat pumps of more than 5 tons (2,731 units, up 15% from 2,373 units in 1986): Canada 937; Australia 739; Britain 253; and France 213.

Split-system heat pumps (14,632 units, up 43.9% from 10,168 units in 1986): Canada 10,170; Mexico 759; France 457; Britain 440; Liberia 391; and Hong Kong 378.

All-year heating-cooling packages 5 tons and under (25,316 units, up 49.1% from 16,977 units in 1986): Canada 21,319; Mexico 814; Bahamas 359; Britain 262; Peru 226; Korea 200; and Arab Emirates 197.

All-year heating-cooling packages over 5 tons (9,411 units, up 115.5% from 4,368 units in 1986): Canada 6,716; Hong Kong 775; Britain 454; Saudi Arabia 445; Mexico 341; and Australia 144.

Self-contained air conditioners 5 tons and under (22,843 units, up 26.7% from 18,031 units in 1986): Canada 10,244; Britain 1,104; Mexico 893; Taiwan 871; France 785; Kuwait 728; Australia 702; Japan 638; Saudi Arabia 586; and Arab Emirates 489.

Self-contained air conditioners over 5 tons (11,627 units, up 24.9% from 9,309 units in 1986): Canada 5,479; Saudi Arabia 1,126; France 872; Britain 725; Kuwait 540; Netherlands 269; and Mexico 203.

Air conditioning condensing units of 5 tons and under (44,701 units, up 95.6% from 22,857 units in 1986): Canada 20,130; Arab Emirates 4,580; France 3,332; Saudi Arabia 2,484; Panama 1,596; Hong Kong 966; Britain 943; and Dominican Republic 933.

Air conditioning condensing units over 5 tons (7,787 units, up 36.5% from 5,707 units in 1986): Canada 3,691; Saudi Arabia 1,131; Arab Emirates 545; and Kuwait 228.

Room fan-coil units (21,455 units, up 61.1% from 13,316 units in 1986): Canada 8,131; Saudi Arabia 1,920; Kuwait 1,354; Arab Emirates 1,324;

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West Germany 1,184; Korea 1,136; and Hong Kong 1,074.

Variable air volume terminal units (12,585 units, up 161.2% from 4,818 units in 1986): Canada 4,132; Australia 2,192; Venezuela 1,252; Mexico 767; and Japan 747.

Central-station air handlers (3,701 units, up 1.5% from 3,646 units in 1986): Saudi Arabia 1,361; Iraq 269; Kuwait 233; Venezuela 206; Phillipines 132; and Italy 129.

Centrifugal liquid chillers (1,007 units, down 12.7% from 1,154 units in 1986): Taiwan 296; Canada 175; Hong Kong 140; Singapore 50; Saudi Arabia 40; and China 40.

Absorption liquid chillers (74 units, up 136% from 35 units in 1986): Taiwan 24; Spain 12; West Germany 11; and Canada 9.

Reciprocating liquid chilling packages (1,527 units, down 11.8% from 1,732 units in 1986): Saudi Arabia 297; Canada 288; Iraq 149; Hong Kong 128; and Arab Emirates 99.

Of the $220.3 million in **air conditioning machinery and parts**, up 14.9% from $191.8 million in 1986, Saudi Arabia accounted for $40.2 million; Canada $31.5 million; Mexico $20.2 million; France $10.8 million; Venezuela $8.2 million; Britain $7 million; West Germany $6.9 million; Philippines $6.4 million; Australia $5.5 million; Hong Kong $5 million; and Japan $4.9 million.

Ice-making machines (22,024 units, up 18.5% from 18,592 units in 1986): Canada 7,679; Taiwan 1,338; Britain 1,236; Mexico 990; Japan 853; West Germany 740; Italy 472; Hong Kong 449; and Columbia 434.

Drinking water coolers (135,647 units, up 81% from 74,958 units in 1986): Canada 66,343; Saudi Arabia 43,997; Japan 4,143; Singapore 2,961; Arab Emirates 2,752; Hong Kong 2,466; Britain 1,890; and Korea 1,158.

Refrigerated self-contained enclosures (30,341 units, up 24.3% from 24,410 units in 1986): Canada 8,627; Britain 5,468; Saudi Arabia 4,460; Japan 1,665; Hong Kong 640; Panama 631; and Netherlands 627.

Refrigerated enclosures, commercial type (11,209 units, up 85.5% from 6,054 units in 1986): Saudi Arabia 2,829; Canada 1,985; Japan 1,077; Mexico 570; and Costa Rica 487.

Heating equipment

From the scope of the products contained in the Department of Commerce report, the value of U.S. heating equipment and parts exports in 1987 totaled $110,797,780, up 25.4% from the $88,369,633 worth exported in the previous year.

Imports totaled $196,252,360 in 1987, an increase of 12% from the $175,150,578 total for 1986. The negative balance of trade for heating equipment last year was $85,454,580, down 1.5% from $86,780,945 in the previous year. Exports were 56.5% of imports, up from 50.5% in 1986.

The leading export markets for heating products were: Canada $38.7 million; Belgium $9.2 million; Korea $7 million; Japan $6.8 million; Netherlands $3.6 million; Britain $3.6 million; West Germany $3 million; Israel $2.5 million; and China $2 million.

The U.S. was a primary market for imports from: Canada $43.6 million; Japan $41.6 million; Taiwan $35.6 million; West Germany $23.5 million; Britain $8.4 million; and Hong Kong $5.2 million.

Imports

The imports and import leaders were:

Fireplace grates ($1,966,967 worth, up 2.2% from $1,924,614 in 1986): Taiwan $1.5 million; China $273,400; and Switzerland $94,430.

Cast iron stoves and parts ($16,383,040, up 3.2% from $15,875,353 in 1986): Taiwan $7.6 million; Japan $1.45 million; Canada $1.7 million; Belgium $1.5 million; France $741,000; and West Germany $710,000.

Heating apparatus designed for wood, coal, or other solid fuels (100,526 units, down 65.9% from 294,819 units in 1986): Canada 33,717; Japan 26,512; Taiwan 22,971; New Zealand 8,593; Spain 2,172; and Australia 1,806.

Other nonelectric heating apparatus (953,424 units, down 17.6% from 1,156,687 units in 1986): Japan 486,582; China 163,015; Canada 66,692; Spain 56,550; Italy 36,716; West Germany 30,729; Britain 30,416; Sweden 14,390; Korea 10,245; and Mexico 10,053.

Heating exports

Following are the leading export markets for U.S. heating equipment and parts:

Domestic heating stoves (151,063 units, up 16.1% from 130,090 units in 1986): Canada 141,644; West Germany 2,789; Israel 990; Japan 966; Britain 948; and Sweden 820.

Oil and gas burners for central heating (24,486 units, down 48.9% from 47,950 units in 1986): Belgium 4,672; Korea 3,177; Netherlands 2,451; Canada 2,260; Portugal 2,163; Nigeria 1,500; and Britain 1,467.

Other heating equipment ($18,084,604, up 15.5% from $15,663,306 in 1986): Canada $7.3 million; Netherlands $2.3 million; Japan $1.1 million; West Germany $1 million; Mexico $679,000; and Thailand $524,000.

Heating parts ($32,252,141, up 41.3% from $22,818,174 in 1986): Canada $12.3 million; Britain $1.2 million; Mexico $1.1 million; New Zealand $1 million; and Australia $989,000.

Oil burners (19,407 units, up 27.6% from 15,209 units in 1986): Canada 6,076; Korea 3,253; China 1,433; Dominican Republic 1,125; Italy 894; and Britain 823.

Gas burners (18,078 units, up 33.9% from 13,503 units in 1986): Japan 4,585; Belgium 4,345; Canada 4,245; China 570; Taiwan 538; and Saudi Arabia 504.

Other industrial burners ($30,870,218, up 35.3% from $22,824,976 in 1986): Canada $6.5 million; West Germany $3.8 million; Venezuela $3.7 million; Japan $3.2 million; France $1.8 million; Switzerland $1.2 million; and Korea $1 million.

Each Statistical Panorama includes the latest data available. Sources frequently revise their previous year's figures, which explains apparent discrepancies between the latest and earlier published data. Where sources give significantly varying information, that data is mentioned.

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WHOLESALERS

Air conditioning and refrigeration parts-and-supplies wholesalers report that dollar volume in 1988 should increase over last year's total volume by 8.3%, according to a forecast by 55 members of the Air-conditioning and Refrigeration Wholesalers (ARW).

The forecasted volume increase varies for the five regions of the United States from 1.6% in the Northeast to 17.6% in the West. Both the Central and Southwest regions expect a 7.5% increase while wholesalers in the Southeast expect sales volume to increase by 9%. Canadian members are looking for a 5.3% increase in 1988.

Wholesalers expect inflation this year to average 3.5% in the U.S. (the median forecast is for a 3% increase from inflation). Canadian wholesalers are looking for a 3.8% inflation rate. The median Canadian forecast was 4%.

Over past years ARW has kept a record of how well its forecasts have matched up with actual experience. Here are the forecasts for five of those years together with the actual sales performance for that year in parentheses: 1987 — 8.4% (6.6%); 1986 — 9% (2.2%); 1985 — 9.5% (4%); 1984 — 11.5% (14.1%); and 1983 — 7.4% (12.6%).

The 1988 forecast was conducted with the assistance of Profit Planning Group, a Boulder, Colo., consulting firm under the auspices of ARW's Marketing and Statistical Committee.

It should be noted, also, that sales volume responses have been weighted to more accurately take into account the fact that wholesalers vary widely in both size and location. For example, a firm with $20 million in sales that projects a 10% increase would be given twice the value, or weight, of a firm projecting the same increase but with only $10 million in volume.

Because ARW wholesalers traditionally have been oriented toward parts and pieces, their business depends much more on the number of system repairs being made in a given year than on the much more volatile new construction equipment market. For this reason, ARW members tend to experience flat sales during recession years, rather than declines, and lesser gains in boom years.

For example, when unitary shipments declined by 21% in 1982, ARW member volume increased by 2.2%. And when unitary shipments rebounded by 43% a year later, the increase for ARW wholesalers was a more modest 12.6%.

Looking across the national forecasts located in this section, again there are no anticipated major increases this year. The biggest increase, at 7.7%, is for refrigerants. It's followed by electric motors at 7.2% and refrigerant flow control valves at 6.9%.

Reflecting the contrast between residential and light commercial air conditioning equipment sales potential this year, ARW wholesalers are looking for a 6.1% increase in units of 4 tons and under. But for the larger equipment, the increase is forecast at only 2.7%.

The regions

On a regional basis, wholesalers in the West expect that the anticipated 17.6% increase will come primarily from increased repair and maintenance services. The top gainers include pipe, tube, and fittings at 10.4%, water treatment and maintenance chemicals at 9.5%, and air filters and air cleaners at 7.9%.

Wholesalers in the Northeast appear to have the least to cheer about. They see unitary equipment sales as generally flat. Slight declines are expected for refrigerant, pipe and tubing fittings, pipe and tubing insulation, and air filters and cleaners. Bigger drops are anticipated for new construction-oriented grilles, registers, and diffusers, sheet metal and fittings, and for water treatment and maintenance chemicals.

Canadian wholesalers, who expect a 5.3% increase in 1988 sales volume, also see only modest increases in most categories. The only decline, 6.6%, is in sheet metal and fittings. Among the more promising products this year are refrigerant, refrigeration coils and condensing units, and replacement compressors.

ARW reported that the median period for accounts receivable (collection period) in 1987 for U.S. members was 49 days. Contractors in Canada take longer to pay their bills. The median accounts receivable period in Canada last year was 69 days.

Some trends

A study conducted last year for ARW by Arthur Andersen & Co. revealed that, in 1985, some 70% of its wholesaler members were using electronic data processing systems, up from 50% only five years earlier. The shift in emphasis from outside to inside sales is expected to continue through 1995.

The study also indicated that the consolidation of wholesalers generally can be expected to continue. Andersen said the 320,000 wholesalers in existence in 1986 will be reduced by 23% to 245,000 by 1995. Wholesalers can expect stable, if somewhat reduced, gross margins in the same period.

Of those who will buy wholesale firms, Anderson said 43% will be other wholesalers seeking to expand their market share, 27% will be other wholesalers seeking economies of scale, 15% will be manufacturers seeking forward integration, 8% will be firms from other industries seeking to diversify their operations, and 7% will be wholesaler customers seeking backward integration.

Between now and 1995, Andersen said traditional wholesaler functions will be reduced by 13% (from 78% of total volume to 68%). The changes: Direct mail and catalog sales will increase by 60% (from 5% to 8%); retailing will increase by 25% (from 4% to 5%); processing and manufacturing will increase by 33% (from 6% to 8%); and other operations, such as sales of information, will increase by 57% (from 7% to 11%).

NHAW

Members of the Northamerican Heating and Airconditioning Wholesalers Association (NHAW) reported that dollar sales in 1987 increased by an average of 12.93% over sales recorded in the previous year. The median increase for the 107 reporting wholesalers in the U.S. and Canada was 12%.

NHAW relies more heavily on me-

TURN TO PAGE 100

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Percent of dollar value potential for 1988 vs. 1987

Product	Northeast	Southeast	Central	Southwest	West	Total U.S.	Canada
Unitary AC&H equipment (4 tons and under)	0.6	7.9	5.9	3.2	N.A.	8.1	3.4
Unitary AC&H equipment (over 4 tons)	-0.5	2.5	3.6	3.3	N.A.	2.7	3.1
Refrigeration condensing units	1.9	4.0	6.0	6.3	5.7	4.7	6.0
Refrigeration coils	2.0	6.0	7.1	7.5	7.3	6.2	5.8
Replacement compressors	6.8	7.8	3.3	5.9	7.0	6.3	5.7
Refrigerant	-0.8	13.5	2.7	1.8	3.7	7.7	6.9
Driers, strainers, filters, and sight glasses	3.3	9.0	5.3	1.5	4.0	6.5	1.9
Refrigerant flow controls — TEV, solenoid, regulating valves, etc.	0.5	10.7	4.4	1.8	5.0	6.9	1.8
Pressure and temperature controls	1.0	8.1	4.3	1.8	6.1	5.7	2.8
Electrical controls — relays, contactors, and starters	0.9	9.5	4.4	1.5	5.9	6.4	2.7
Capacitors	2.3	8.5	4.4	1.5	3.3	5.8	2.5
Electric motors	2.2	9.6	6.2	3.7	6.0	7.2	1.6
Pipe and tubing fittings	-0.1	6.7	3.5	1.2	10.4	4.8	2.6
Pipe and tubing insulation	-0.1	5.3	2.3	1.2	7.7	3.6	2.6
Grilles, registers, and diffusers	-5.2	3.9	6.3	1.5	N.A.	3.2	0.2
Sheet metal and fittings	-3.3	2.1	5.8	1.5	N.A.	2.4	-6.6
Air filters and air cleaners	-0.2	5.8	6.6	10.1	7.9	6.2	1.5
Water treatment and maintenance chemicals	-5.3	4.0	4.4	1.2	9.5	3.2	1.2
Instruments and test equipment	3.0	6.6	4.8	1.5	4.8	5.1	1.5
Totals	**1.6**	**9.0**	**7.5**	**7.5**	**17.6**	**8.3**	**5.3**

1988 SALES FORECAST undertaken by members of the Air-conditioning and Refrigeration Wholesalers (ARW) shows an overall gain of 8.3% in dollar volume over 1987. A total of 55 firms submitted data. The figures represent the weighted average (by sales volume) of all responses. Total sales represent the arithmetic average of all wholesaler estimates of 1988 total sales and are not an aggregate of the product categories.

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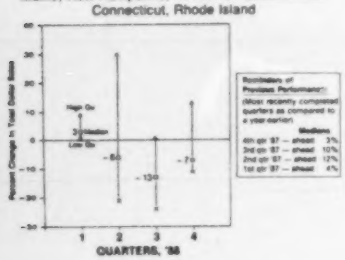

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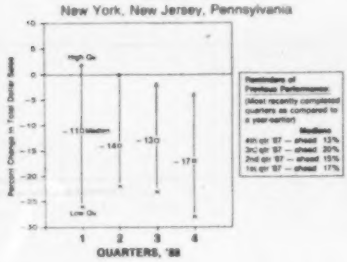

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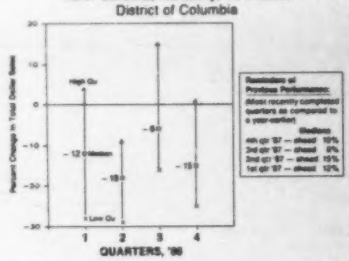

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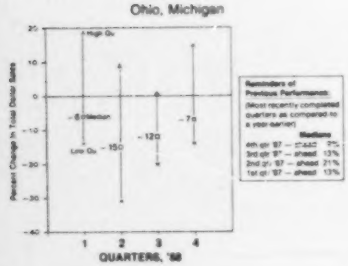

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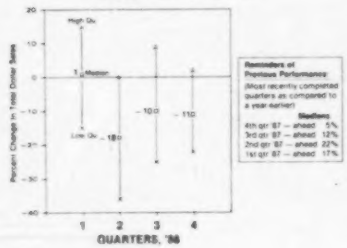

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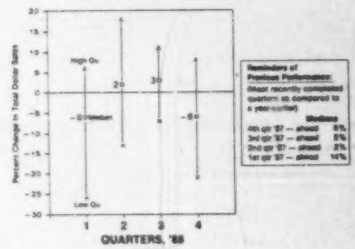

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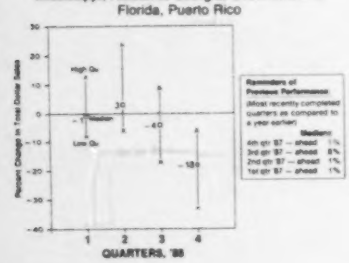

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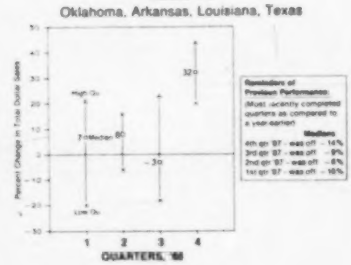

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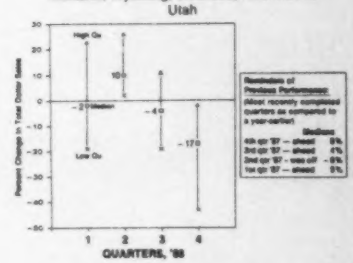
Utah



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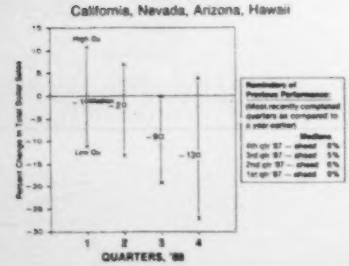
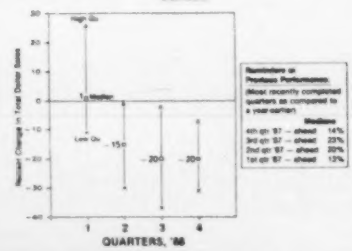
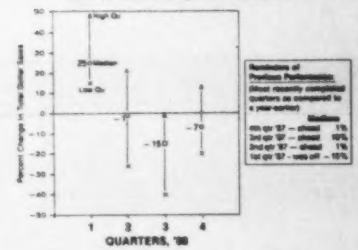


REGION 11
Canada



REGION 12
Idaho, Alaska, Oregon, Washington



REGIONALITY was again prevalent in these forecasts supplied by the Northamerican Heating and Airconditioning Wholesalers Association (NHAW). They depict the expectations of the upper quartile, lower quartile, and median of all reporting wholesalers in that region.

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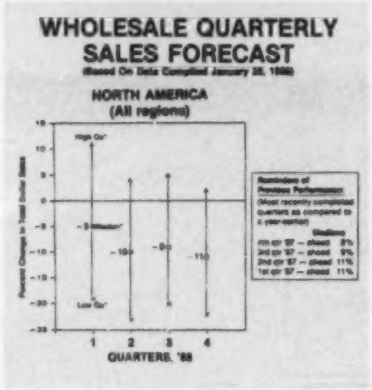
dians (the number in the middle when individual reports are arranged from low to high) than on averages (the arithmetic mean of all results). To avoid confusion, we'll stick to medians even though both medians and averages are included in the organization's reports.

On a national basis, the lower quartile of firms showed a median growth of only 3.3% last year while the upper quartile of reporting firms recorded a median gain of 20.4%.

The disparity among regions, however, was significant. For U.S. firms, the medians ranged from -4.3% in Region 9 (Montana, Wyoming, Colorado, New Mexico, and Utah) to a high of 18.7% in Region 2 (New York, New Jersey, and Pennsylvania). However, the five Canadian wholesalers, reporting as a group, fared better (median increase 23.5%) than any U.S. region.

Double-digit median increases were recorded by Region 4 (Ohio, Michigan) at 14.6%; by Region 3 (Delaware, Maryland, Virginia, West Virginia,



North Carolina, Kentucky, Tennessee, and Washington, D.C.) at 13.2%; by Region 5 (Indiana, Illinois, and Wisconsin) at 12.8%; by Region 12 (Idaho, Alaska, Oregon, and Washington) at 12%; and by Region 10 (California, Nevada, Arizona, and Hawaii) at 10.5%.

Smaller median increases were recorded by Region 7 (Alabama, Georgia, South Carolina, Florida, Puerto Rico, and Mississippi) at 6.4%; and by Region 6 (Minnesota, Iowa, Nebraska, Montana, Kansas, North and South Dakota) at 6%.

In terms of firm size, the disparity was less pronounced. The best performers were those firms with annual sales volumes with $4 million to $5 million (median increase 16%) and $2 million to $3 million (median increase 15.9%). The smallest increase (median increase 4%) was recorded by firms in the $5 million to $7.5 million annual sales volume category.

However, the median 13.2% increase recorded by the largest (annual sales volume of $10 million or more) clearly continues the trend toward large-company capture of increasing market share.

1988 forecast

Looking ahead, NHAW provides a quarter-by-quarter comparison of total sales — nationally and by region — compared to the identical quarter in the previous year. No longer does it provide forecasts according to product groupings.

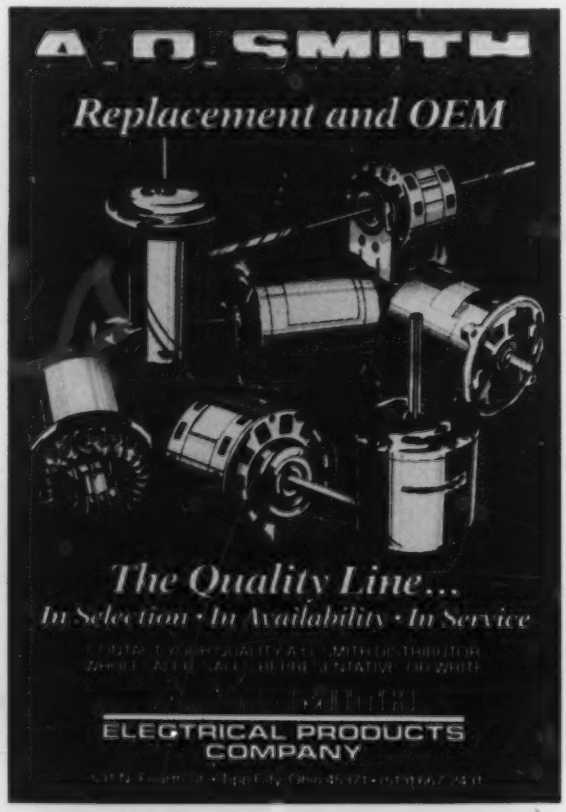
Although the 1988 quarterly forecast indicates declines ranging from 5% to 11%, NHAW reminded its members that 1987 sales increased from 8% to 11% on a national basis. In a broad sense, then, NHAW expects 1988 to be at least as good as 1986.

The forecast is prepared for NHAW by William Spooner and Associates, Inc. It relates to data supplied by NHAW members and with econometric models maintained by the University of California at Los Angeles (UCLA), which develops a forecast for the nation based on the DRI econometric model.

Again, there is wide disparity between regions. In the Northeast (Region 2), which recorded the biggest U.S. increase last year, it's expected sales volume will be down from 11% to 17%. In the oil-producing states (Region 8), however, wholesalers are looking for a long-awaited comeback with only a minor dip of 3% in one quarter and other quarterly increases ranging from 7% to 32%.

As in the national chart, it should be noted that there is often a wide range between the upper and lower quartiles in almost all of the individual regions.

As in the national chart, it should be noted that there is often a wide range between the upper and lower quartiles in almost all of the individual regions.



Circle 43

FUELS AND ENERGY

United States energy consumption for the first 11 months of 1987 was 68.924 quadrillion Btu (quads), an increase of 2.3% over the 67.362 quads consumed during the same period in 1986.

To add some perspective, the nation's energy consumption for the full year 1986, at 74.246 quads, was almost identical to the 74.282 quads consumed 13 years before in 1973, the year of the Arab oil embargo. That total — and the final tally for 1987 — also is considerably below the peak consumption total of 78.897 quads set in 1979, just after the second major oil price shock.

In the residential and commercial sector (the Energy Information Administration lumps them together), the 24.796 quads consumed in the first 11 months of 1987 was 2.3% more than the 24.239 quads consumed during the same period a year earlier. The 1986 full-year total of 27.032 quads represents a 12% increase over the 24.142 quads used by the residential-commercial sector in 1973.

During the first 11 months of 1987 this sector represented a 36% share of total energy consumption, down a hair from the 36.4% share for the same period in 1986 and up considerably from the 32.5% share for this sector in 1973.

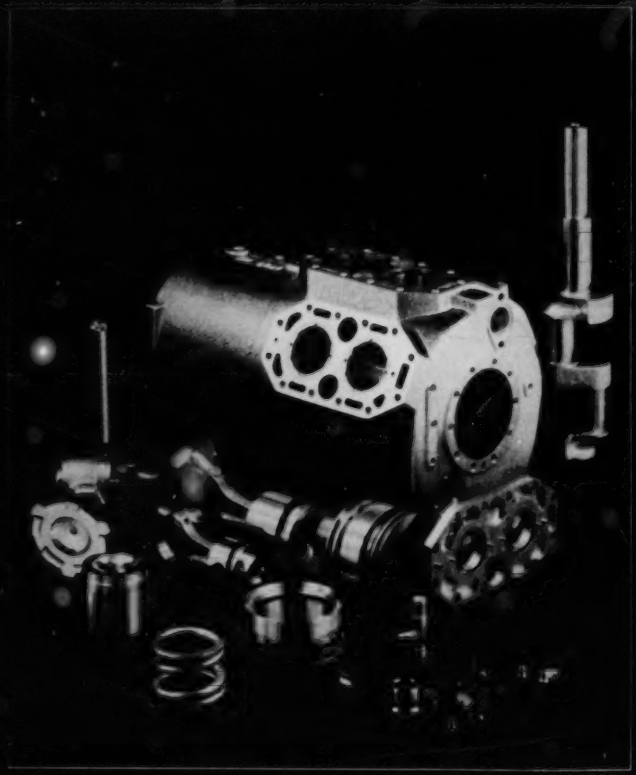
Industrial sector consumption of 24.745 quads for the first 11 months of 1987 was up 2.5% over the 24.137 quads consumed by this sector in the same period of 1986. The full-year 1986 total of 26.424 quads was 16.2% lower than the 31.536 quads consumed by the industrial sector in 1973.

During the first 11 months of 1987, the industrial sector represented a 35.9% share of total energy consumption, almost the same as the 35.8% share for the same period a year earlier. In 1973, the industrial sector consumed 42.5% of the nation's energy.

For the record, the transportation sector consumed 19.363 quads during the first 11 months of 1987, a 2% increase over the 18.985 quads consumed by this sector in the same period of 1986. It represented a 28% share of total energy consumption for the 1987 period, down a hair from the 28.2% share for the same period in 1986. The share in 1973 was 25%.

Electric utilities consumed 25.125 quads of energy during the first 11 months of 1987, an increase of 3.2% over the amount consumed during the same period the previous year. The 1986 full-year total of 26.665 quads was 34.4% more than the 19.853 quads consumed by electric utilities in 1973.

Of the 24.796 quads consumed by the residential-commercial sector during the first 11 months of 1987 (with the share for same period a year earlier in parentheses), only 0.58% (0.66%) was



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coal; 24% (24.4%) was natural gas; 9.25% (9.3%) was petroleum; 20.2% (19.8%) was electricity; and 46% (45.9%) was electrical system generation and transmission losses.

Similarly, the 24.745 quads used by the industrial sector during the first 11 months of 1987 (with the share for the same period in 1986 in parentheses) broke down this way: 9.5% (10%) coal; 25% (25.2%) natural gas; 30.3% (29.9%) petroleum; 10.7% (10.5%) electricity; and 24.3% (24.3%) were electricity generation and transmission losses.

Conservation

In order to get a gross measure of conservation, DOE records show that, in 1973, it took 27,100 Btu to generate each 1982 constant dollar of GNP (gross national product). In the third quarter of 1987 it took 20,100 Btu to generate a constant dollar of GNP, or 25.8% less than in 1973. The 1987 figure also was 1% higher than the 19,900 Btu it took to generate a constant dollar of GNP in the third quarter of 1986.

In simpler terms, it means that the U.S. economy in the third quarter of 1987 produced at a rate of 3.836 trillion constant 1982 dollars worth of goods and services with 25.8% greater efficiency than in 1973. Had it not been for this efficiency increase over the 14-year period, U.S. energy consumption would have been at the rate of 96.96 quads in the third quarter of 1987 instead of the actual 77.075 quads.

Fuel costs

The average price for No. 2 fuel oil in October, 1987, was 86.3 cents/gal, an increase of 17.7% from the 73.3 cents/gal average in October, 1986. The 1987 price was, however, 23.2% less than the $1.119/gal charged in November, 1985. It also represents a 27.6% drop from the average price of $1.194/gal paid in November, 1981. The residential cost of No. 2 fuel oil in 1978, just before the second oil price shock, was 49 cents/gal.

In October, 1987, the price of No. 2 fuel oil to homes ranged from 74.6 cents/gal in Pittsburgh through 90.5 cents/gal in Chicago and 91.7 cents/gal in New York City to 97.1 cents/gal in Washington, D.C., according to EIA figures.

Average residential natural gas prices in October, 1987, declined by 4.6% to $5.57/1,000 cu ft from $5.84/1,000 cu ft in the same month a year earlier. This follows a 6.7% drop from November, 1985, to November, 1986.

It should be remembered, however, that the October, 1987, price still is 51.4% higher than the $3.68/1,000 cu ft charged in 1980 and 332% higher than the $1.29/1,000 cu ft average in 1973.

In the case of specific cities, EIA reported that, in October, 1987, the price of natural gas expressed in dollars per 1,000 cu ft ranged from $4.19 in Houston and $4.22 in Chicago through $5.18 in Detroit and $6.90 in Philadelphia to $8.83 in Los Angeles.

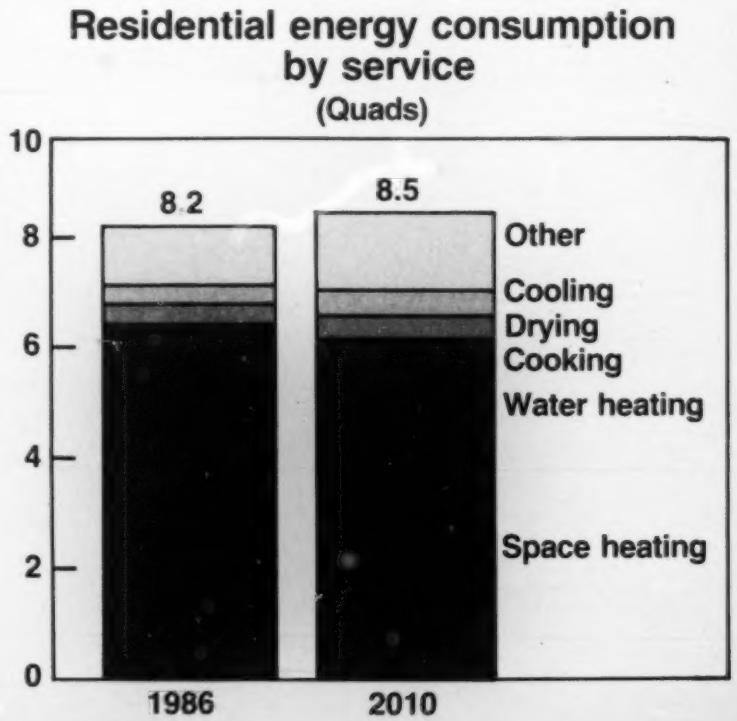
The average price charged residential customers by privately owned electric utilities in October, 1987, was 7.66 cents/kWh, or 0.26% less than the 7.68 cents/kWh charged at the same time a year earlier. The small decline last year follows a 5.56% drop a year earlier.

The 1987 average price, however, was 77.7% higher than the 4.31 cents/kWh charged in 1978 and 202% higher than the 2.54 cents/kWh charged in 1973.

In the case of specific cities, EIA reported that, in October, 1987, the price of residential electricity expressed in dollars per 500 kWh, ranged from $37.87 in Houston and $38.61 in St. Louis through $47.48 in Miami and $50.64 in Boston to $57.06 in New York City.

The average price electric utilities charged commercial customers in November, 1987 (the latest date for which these figures are available), was 7.26 cents/kWh, down 0.68% from 7.31 cents/kWh for the same month a year earlier. The 1987 price represents a 66.5% increase over the 4.36 cents/kWh charged in 1978 and a 201% increase over the 2.41 cents/kWh charged in 1973.

Similarly, the average price electric utilities charged industrial customers in November, 1987, was 4.69 cents/kWh, a 4.9% decline from the 4.9 cents/kWh charged in the same month of 1986. The 1987 price represents a 68.1% increase over the 2.79 cents/kWh charged industrial customers in 1978 and a 275% increase



over the 1.25 cents/kWh charged in 1973.

Total net electricity generation for the first 11 months of 1987, the latest period for which these data are available, was 2,350,916 million kWh, an increase of 3.4% over the 2,273,759 million kWh generated over the same period in 1986, according to EIA.

Increases over the past four years reflect the slow but steady expansion of the economy. The electricity generation increases also reflect the highly regional nature of that expansion.

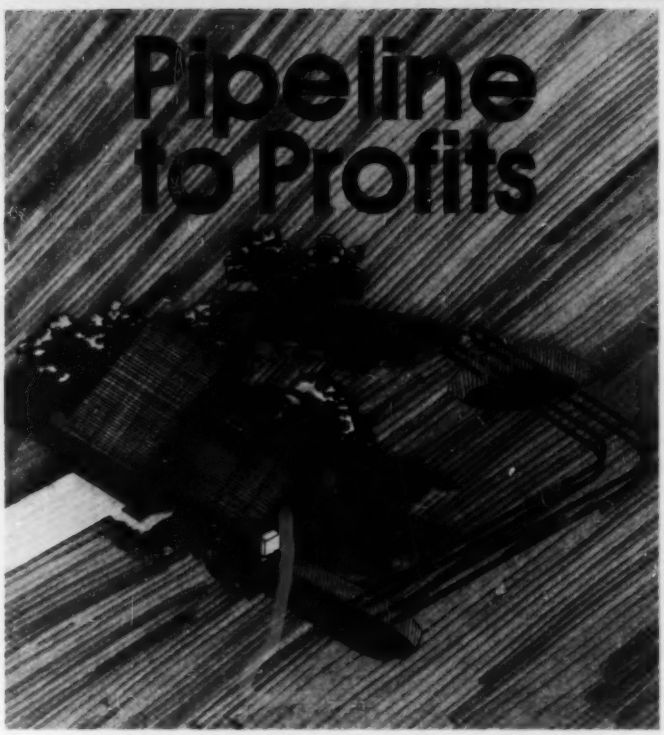
Some examples. The Mountain states, at 6.6%, the East North Central states, at 5.9%, and the Middle Atlantic states at 5.4% were all big gainers. New England and the West South Central region (Arkansas, Louisiana, Oklahoma, and Texas), on the other hand, experienced only a 0.1% increase in electricity generation. Alaska had a 4% drop.

EIA reported that, of the total amount of electricity generated during the first 11 months of 1987, some 56.9% came from coal, up from 55.7% for the same period in 1986; 4.6% came from petroleum, down from 5.5% a year earlier; 10.8% came from natural gas, up from 10.2% a year earlier; 9.7% came from hydroelectric facilities, down from 11.6% in 1986; 17.6% came from nuclear plants, up from 16.5% the previous year; and 0.5% came from "other" sources in both years.

Net generation from hydroelectric units during the first 11 months of 1987 was 228,532 million kWh, 14% lower than for the same period in 1986 and the lowest level since 1977. Water levels in the Rocky Mountains, Southwest, and West were below normal. Net generation was 29% less in the Mountain states and 21% less in the West Coast states than in the same period a year earlier.

Electricity sales to ultimate consumers for the first 11 months of 1987 totaled 2,250,528 million kWh, a 4.6% increase over the 2,151,354 million kWh sold during the same period a year earlier, according to EIA.

Of the 11-month total in 1987, residential sales (with a 34.5% share) amounted to 776,589 million kWh, up 4.8% from 744,718 million kWh for the same period in 1986; commercial sales (with a 27.5% share) amounted to 617,479 million kWh, up 5% from 588,219 million kWh in 1986; industrial sales (with a 34.5% share) amounted to 776,911 million kWh, up



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4.7% from 742,298 million kWh a year earlier; and "other" sales (with a 3.5% share) amounted to 79,548 million kWh, up 4.5% from 76,119 million kWh for the first 11 months of the previous year.

The installed nameplate capacity of U.S. electric generating plants as of Dec. 31, 1987, was 718,822 megawatts (MW), up 6.1% from 677,384 MW at the same time a year earlier. Of this, 58.9% was steam, 14.1% was nuclear, 11.9% was hydro, 7.2% was gas turbine, 0.72% was internal combustion, 0.24% was geothermal, 7 MW was wind, and 15 MW was solar energy, according to the Edison Electric Institute.

EEI reported that, at the end of 1987, the average number of electric utility customers was 104,703,386, up 1.9% from 102,737,897 customers at the same time a year earlier.

Nuclear

In November, 1987, U.S. nuclear generating units produced a total of 37,438 million net kWh, up 7.1% from the 34,944 million kWh total for the same month a year earlier.

Also last November, nuclear units generated electricity at an average capacity factor of 55.5%, or 1% lower than in November, 1986. Nuclear power supplied 18.7% of the total U.S. electricity generated in November, 1987, up from 17.8% in the previous November.

As of November 30, 1987, there were 107 operable nuclear generating units in the United States with a collective net summer generating capacity of 94 million kWh of electricity. Five days earlier Palo Verde 3 was issued a full-power operating license. Three others — Seabrook 1, Shoreham, and South Texas 1 — were issued low-power operating licenses last year by the Nuclear Regulatory Commission (NRC).

Of the 107 operable units, 32 units generated less than 25% of capacity. Of these 32 units, 24 were out of service at least part of the month for maintenance or refuelling.

As of November 30, there were 127 domestic nuclear generating units in all stages of planning, construction, and operation. They have an aggregate net design capacity of 119 million kWh. It's also significant to note that no new nuclear power plants have been announced since 1978 and that, since then, plans for dozens of plants have been cancelled.

Natural gas

Gas utility thermal equivalent sales in 1987 totaled 10,869 trillion Btu, a 2.3% decrease from the total of 11,126.4 trillion Btu recorded in 1986, according to preliminary figures released by the American Gas Association (AGA). The total for 1987 also represents a 13.8% drop from the 1985 total of 12,615 trillion Btu.

It should be noted, however, that an additional 3,337.3 trillion Btu equivalent was recorded in 1987 for transportation, an increase of 62.8% over the 1986 transportation total of 2,049.9 trillion Btu. Much of this increase represents direct sales by producers to large industrial and commercial customers that bypass local utilities. This is one way the producers have retained these large customers in the face of lower oil prices.

Industrial sales, which accounted for 20.8% of the total, were 2,258 trillion Btu in 1987, down 21.9% from 2,892 trillion Btu a year earlier. The industrial sector accounted for 26% of total sales in 1986. Sales for electricity generation (17.2% of the total) in 1987 totaled 1,866.1 trillion Btu, up 28.8% from the previous year's total of 1,448.7 trillion Btu. The 1986 share for this sector was 13%.

Residential sales (40.4% of the total) in 1987 amounted to 4,395.6 trillion Btu, up 0.4% from the previous year's total of 4,380.1 trillion Btu. The residential sector had a 39.4% market share in 1986.

Commercial sales (20% of the total) last year were 2,169.7 trillion Btu, down 3.1% from the 1986 total of 2,238.4 trillion Btu. The "other" category (1.6% of the total) was 179.6 trillion Btu in 1987, almost even with the 167.2 trillion Btu total for the previous year.

AGA reported that the December, 1987, average natural gas utility prices, expressed in dollars per million Btu and with the December, 1986, prices in parentheses, were: all $4.48 ($4.55); residential $5.05 ($5.15); commercial $4.70 ($4.72); industrial $3.56

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($3.59); electricity generation $2.77 ($2.75); and industrial and electricity generation grouped together $3.29 ($3.34).

Exploration

Total exploration and development well completions in 1987 amounted to 33,150 wells, a decline of 12.3% from the 37,810 wells completed in the previous year. Both years are dramatically lower than the 90,130 wells completed in the peak year of 1981.

Oil well completions in 1987, at 15,470, were down 14.9% from the 18,170 oil wells completed in 1986. The 7,070 gas wells completed last year represented a decline of 7.5% from the 7,640 gas wells completed in 1986. The remainder were dry wells, which have averaged 31% of all wells drilled in the last decade.

Total footage drilled in 1987 amounted to 146.72 million feet, down 13.5% from the 169.58 million feet drilled in the previous year. In the peak year, 1981, a total of 408.84 million feet were drilled.

In 1987, the average number of rotary rigs in operation was 936, down 2.9% from the 1986 monthly average. Offshore rigs in 1987 constituted 10.2% of the total and onshore rigs the other 89.8%. The 95 offshore rigs represented a 4% decline from the 99 offshore rigs operating in 1986. The average of 841 onshore rigs was down 2.8% from the average of 865 onshore rigs in the previous year.

Also in 1987, the average number of crews engaged in seismic exploration was 197, down 2% from the average of 201 crews in the previous year. Of the 1987 total, 153 were land crews, down 13% from the 176-crew average in 1986, and 24 were marine vessels, the same number as in 1986.

In January, 1988, the number of crews engaged in seismic exploration decreased, if only slightly, for the first time since March, 1987. Similarly, the rotary rig count declined for the first time since April, 1987.

Imports

United States net imports of energy for the first 11 months of 1987 amounted to 10.533 quads, an increase of 1.45% over the 10.378 quads for the same period of 1986. This amounts to 15.3% of domestic consumption. Or, put another way, the U.S. produced 84.7% of all the energy it consumed during the first 11 months of 1987.

It's also significant that, in the third

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quarter of 1987, the U.S. was importing 39.5% of the petroleum products supplied to the domestic market, up from 38.8% in the third quarter of 1986. Of the 6,571 barrels/day of oil imported in the third quarter of last year, 3,540 barrels/day — or 53.9% — came from Organization of Petroleum Exporting Countries (OPEC) nations and 1,478 barrels/day, or 22.5% came from Arab OPEC nations.

Of the 10.533 net quads of imported energy over the first 11 months of 1987, crude oil accounted for 8.873 quads, or 84.3%; petroleum products accounted for 2.363 quads, or 22.4%; Natural gas accounted for 0.743 quads, or 7%; electricity accounted for 0.385 quads, or 3.7%; and coal and coke accounted for 0.01 quads, or 0.09%. On the positive side, coal exports accounted for 1.841 quads, or 17.5%.

In dollar terms, the $7.713 billion in energy exports last year (up 5% from $8.115 billion in 1986) failed to cover the $44.22 billion in energy imports (up 18.5% from $37.31 billion in 1986). The negative balance in the nation's energy account last year was $36.507 billion, up 25% from the $29.195 billion imbalance in 1986. It should be noted, however, that the U.S. had a $74.942 billion negative energy trade balance in 1980.

A look ahead

Even though world oil prices have recovered a bit since, the sharp decline in oil prices starting in late 1985 has had a significant impact on U.S. energy pricing. This has been particularly true for natural gas.

The natural gas industry has depended upon the industrial and electric utility markets for more than half its sales. Most large users in these markets can readily switch from gas to oil. So when the price of residual fuel oil fell below that of natural gas, on a Btu-equivalent basis, many large gas users switched to oil.

Over the past two years, gas producers and pipeline companies have negotiated "carriage" supply contracts with many of these large users which, in effect, bypass local utilities. In 1982, only 3% of interstate gas was transported under carriage arrangements. In 1987, about 50% of industrial gas and more than 90% of gas supplies to electricity generating plants were under some type of carriage arrangment.

In a detailed study of future energy markets, the Gas Research Institute (GRI) forsees ample natural gas supplies well beyond the turn of the century. Gas transportation over the next 20 years, however, will have to shift to take advantage of Mountain state, Canadian, and Alaskan North Slope gas fields. Too, more than 80% of the increase in population is expected to occur in California and the Atlantic region, both far from the maturing Texas-Oklahoma-Louisiana gas fields.

The gas oversupply "bubble" and competition from other fuels is an immediate problem. GRI said it will be some time before competitive carriage tariffs will allow the gas industry to get paid for the full cost of gas recovery. But to do otherwise would load extra transportation charges on the core residential and commercial markets and, perhaps, lose them as well.

GRI perceives a permanent change in energy consumption per dollar of GNP that has important implications for the nation's energy policies, competition between energy sources, and for the natural gas industry in particular. The change is the increasing efficiency of energy use and the restructuring of the economy into less energy-intensive applications.

It projects that primary energy consumption will grow at only 1% per year through the year 2010 while the average growth of the GNP will be 2.4%.

Residential

Residential energy demand is projected to increase at only 0.4% per year over the next 12 years, or less than half the growth rate for housing. It reflects continued energy conservation, much of it already imbedded in building codes and minimum efficiency equipment standards.

Gas consumption is expected to decline from 4.6 quads in 1986 to 4.1 quads by 2010 despite an expected increase in gas-heated homes from 48 million in 1986 to 59 million by 2010. The gas industry expects to hold its 70% share of space and domestic hot water heating but its share of cooking, clothes drying, and space cooling could erode from 40% to 25% over the period.

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Percent of Total End-Use Electricity Demand Provided by Cogeneration

	1986	1990	2000	2010
		Total Demand (Billion kWh)		
Industrial	940.0	1,033.8	1,229.9	1,412.7
Commercial	722.4	757.2	905.1	1,099.2
Total	1,662.4	1,791.0	2,135.0	2,511.9
		Percent of Total Demand		
Industrial	11.5	13.7	15.8	16.6
Commercial	1.2	3.0	7.0	8.2
Total	7.0	9.2	12.1	12.9

The extension of gas distribution lines in the South and the development of a gas-fired air conditioner or heat pump could, however, change that projection.

Commercial

Commercial energy consumption is expected to increase from 6.1 quads in 1986 to 8.7 quads by 2010, or at almost 70% of the rate of growth of commercial square footage. Although it will be down for the next two years, GRI expects commercial construction to approach the rate of growth in GNP after 1990.

The projected 62.5% growth in gas usage in this sector over the period will come from packaged cogeneration systems, heat pumps, and direct-fired absorption systems. GRI recommends moving away from energy cost savings and toward lowering equipment capital costs, ease of installation, better control, and applicability to different building types.

Industrial

Manufacturing accounted for more than 80% of energy consumption in this sector in 1985. Substantial restructuring is moving toward less energy-intensive industries with the result that energy consumption is expected to increase at only 35% of the rate of industrial expansion. Industry accounts for almost 40% of all gas sold in the U.S.

After 1990 industrial gas consumption is expected to remain at roughly 7 quads through the year 2010 because of tough competition in industrial energy markets. Automation tends to favor electricity, GRI said, and even direct heat processes will face competition from emerging electrical technologies.

Electric utilities

GRI expects the percentage of total electricity demand provided by nonutility sources, such as cogenerators, will increase from 8% in 1986 to 12%

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in 2010. But gas consumption by electric utilities will remain flat or decline slightly as new coal and nuclear plants come on stream.

The gas industry sees a major opportunity in the increasing requirement among electric utilities for intermediate and peak generating capability.

If electricity produced through industrial and commercial cogeneration is included, electricity consumption should grow at a rate of 1.6% per year through 2010, or about 70% of the rate of growth of the GNP. Total electric utility energy consumption should grow from 26.9 quads in 1986 to 38.4 quads in 2010 with a resulting increase in primary energy consumption from 35% to 39% in that time period.

Coal

Thanks to abnormally dry weather in the West that led to lower hydroelectric power production, the U.S. coal industry produced a record 910 million tons of coal in 1987, up 2.25% from the previous record of 890 million tons set in the previous year, according to estimates of the National Coal Association (NCA).

According to preliminary figures published by the Energy Information Administration (EIA), the 1987 production total was 916,851,000 tons, or 3% above the 1986 total of 890,315,000 tons.

On the assumption that the weather and hydroelectric generating conditions return to normal this year, NCA's Economics Committee forecasts that 1988 production is expected to total 898 million tons, down 1.3% from the 1987 estimate.

Consumption in 1988 is forecast to reach 905 million tons, 3 million tons below the 1987 consumption level but 15 million tons above 1986 demand. NCA president Richard L. Lawson said uncertainty in the economy has influenced the association to take a conservative approach to forecasting.

Although domestic coal demand is expected to be essentially unchanged this year, he said drawdowns in customer stockpiles and lower export totals will result in slightly less production.

Coal consumption in 1987 by electric utilities, the industry's biggest customer, was 714 million tons, up 4.2% over the 685 million tons consumed by this market sector in the previous year. NCA forecasts that demand by electric utilities in 1988 will be about the same as last year, or 715 million tons.

FUELS

Coal's share of the electricity generation market, at 56% in 1987, will drop a hair to 55% this year because of normal hydroelectric production, a lackluster economy, and the addition of 11.6 million kWh of new nuclear plant capacity coming on line. Only three new coal-fired generating facilities, with a total capacity of 2.2 million kWh, will come on line this year.

Although raw steel production increased sharply in 1987, NCA said the coal industry has not benefited because of increased electric furnace and continuous casting practices. Instead, it said pig iron production, although declining as a percentage of steel production, is a better indicator of coking coal demand.

Coking coal, at 35 million tons in 1987, was down 2.8% from 36 million tons in the previous year. Demand for coking coal is expected to decline by an additional 2.9% this year to 34 million tons.

The industrial and retail sector, which accounted for 81 million tons of coal last year, declined 2.4% from 83 million tons in 1986. The outlook in 1988 is for a 1.2% increase to 82 million tons even though most of the industrial expansion is in manufacturing sectors that do not rely heavily on coal. Competition from natural gas also is a factor.

U.S. coal exports in 1988 are expected to continue the slow downward spiral that has been the case since 1985. Exports in 1987, at 78 million tons, were down 9.3% from 86 million tons in 1986. Exports are expected to decline by another 5.1% this year to 74 million tons.

Exports to Canada this year are expected to decline by 2 million tons to 13 million tons. Overseas exports are expected to decline by a similar amount to 61 million tons in 1988 because of new entrants in the world market — China, Colombia, and Venzuela — and slow growth abroad for steam and steel. The downward trend is expected to continue in future years. Coal imports are expected to remain constant at 2 million tons.

Coal production in the East, which increased last year by 2.3% to 577 million tons, is expected to decline marginally by 1.5% this year to 568 million tons, or 63.3% of the total. Production in the West, which increased by 2.2% in 1987 to 333 million tons, is expected to drop by 1% this year to 330 million tons. The East will absorb most of the decline in exports.

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LABOR

Even though average wage increases for construction trade unions edged above 50 cents/hour for the first time since 1982, contract settlements in 1987 marked the fifth year in a row that average increases were held to less than 2.5%, according to the Construction Labor Research Council (CLRC).

Other trends noted by CLRC included a continuation of longer contract spans, wide regional and craft disparities led by higher-than-average contract settlements in the Northeast, and a proliferation of below-scale wage agreements on a project-by-project basis.

The average first-year increase last year was 54 cents/hour, or 2.2%. If the impact of contract language changes designed to reduce overall labor costs were applied, however, the average increase would be more like 46 cents/hour.

A year earlier, in 1986, the average first-year increase was 48 cents/hour and the net, after applying changes in contract language, was 38 cents/hour.

The average second-year increase in multiyear contracts was 90 cents/hour, or 3.7%. This is in contrast to the 58 cents/hour, or 2.8% increase recorded a year earlier — the lowest since CLRC began reporting on negotiation results in the mid-1970's. Until 1987, average second-year increases had declined each year since 1981.

Regions with above-average settlement levels also negotiated a larger share of multiyear agreements, CLRC reported, so the higher level of second-year increases is primarily the result of a geographic shift. It should also be noted that, as recently as 1981, construction trade wage settlements averaged 12%.

In the early 1980's, increases have been disproportionately channeled into fringe benefits. In 1986, however, most of the money was allocated to wages. Last year the distribution of increases between wages and fringes was in proportion to their share of total wages and fringes.

In 1987, wages increased by 40 cents/hour while health and welfare increased by 7 cents/hour, pensions by 6 cents/hour, and contributions to other funds grew by 1 cent/hour.

Bargaining results, even more than in most years, were the result of local factors, CLRC reported. Where work loads were high and union construction prevalent, settlements were above average. Conversely, weak markets and widespread open shop activity generally led to below-average wage settlements.

Settlements in the Northeast were above average and bargaining activity was heavy. The Northeast accounted for 32% of all workers covered by new agreements in 1987, up from 17% a year earlier. Average increases were considerably higher than those in the rest of the country and were more likely to cover a two- or three-year period.

Compared to 1986, average increases were smaller last year in all other regions with the exception of the Southeast, which was slightly higher. If the Northeast were excluded, the 513 contracts negotiated elsewhere produced an average first-year increase of 23 cents/hour, or 1.1%.

The trend toward longer contracts continued in 1987 although, if all construction labor contracts in force are taken into consideration, the one-year contract is still the most common.

For the first time since 1981, multiyear agreements outnumbered one-year agreements in 1987. Of these, three-year contracts outnumbered two-year pacts. This was primarily due to the larger number of contracts negotiated in the Northeast. One-year contracts continue to dominate in the South Central region.

Contract language changes designed to improve overall labor costs, such as the use of subjourneymen and more flexible crew mixes, were noted in fewer agreements last year by CLRC. Even so, the changes resulted in an average savings of 46 cents/hour, up from 45 cents a year earlier.

There was no pattern last year to the language improvements, CLRC said, adding that these changes offer the most potential for labor cost savings.

Construction industry employment was flat through most of 1987 at a record level just over 5 million workers, the council reported. After two years at 13% or more, unemployment in the construction industry in 1987 dipped below 12% — the lowest since 1979.

The slow employment growth, together with lower unemployment rates, clearly are the result of fewer entrants into the industry, the council concluded. Overall construction volume remained almost unchanged. Lower levels of private construction were balanced by higher levels of public construction. Nonresidential construction was down but residential building was up.

Trades changes

The council's report covers 702 construction labor agreements negotiated in 1987 on behalf of 499,122 workers. The average first-year settlements ranged from a rollback of 84 cents/hour, or 5.2% in Texas, to an increase of $1.50/hour in New York.

In New England and the Middle Atlantic states (with the exception of Pennsylvania), the first-year settlements ranged from $1.20/hour to $1.50/hour, or 5% to 7%. For the 46 agreements negotiated in Pennsylvania, the average first-year settlement was 39 cents/hour, or 2%.

The 56 agreements negotiated in Texas averaged a first-year rollback of 84 cents/hour, or 5.2%. Elsewhere in the South Central region (Arkansas, Louisiana, New Mexico, and Oklahoma), rollbacks averaged 73 cents/hour, or 4.5%. The 25 agreements negotiated in the Mountain and Northern Plains states (Colorado, Montana, North and South Dakota, Utah, and Wyoming) also resulted in rollbacks averaging 52 cents/hour, or 2.7%.

Elsewhere, the Southeast chalked up first-year increases ranging from 24 cents/hour to 32 cents/hour, and the Midwest settlements ranged from 21 cents/hour in Indiana to 88 cents/hour in Michigan. California settlements averaged 43 cents/hour, while the rest of the Southwest Pacific region (Arizona, Hawaii, Nevada) averaged 14 cents/hour.

Of the 44 contracts negotiated by United Association (UA) pipefitters and plumbers covering 30,606 workers, 23 contracts, or 52%, were for more than one year. The average increase in the first year was 32 cents/hour, or 1.4%. The average increase in the sec-

ond year was 5? cents/hour, or 2.2%. Only one of the agreements contained a cost-of-living adjustment clause.

The 28 contracts involving 12,048 members of the Sheet Metal Workers' International Association (SMWIA) were all for one year's duration. The average increase was 62 cents/hour, or 2.3%. None involved cost-of-living adjustments.

Project agreements

When it became apparent to CLRC that the wage and fringe rates specified in new agreements were higher than those actually being paid in more than half of the cases, it queried the organizations providing the data.

The survey revealed some instances of below-scale wage and fringe benefits in all sections of the country except New England. Wages paid in these cases frequently are 10% to 20% below negotiated amounts. These instances are over and above those in which lower rates have been incorporated into contracts.

In the Southeast, and in the Mountain states westward, almost all responses indicated the existence of below-scale projects outside of the collective bargaining agreement. A more mixed picture was noted elsewhere in the country.

In about half of the cases, CLRC reported the practice is the result of a local market recovery or targeted jobs program. Targeted jobs are usually those most likely to be built by open-shop contractors.

Other common below-scale situations involve defined classes of small projects, project agreements, and national maintenance agreements specifying 80% to 90% of local rates. Too, maintenance is being more broadly defined than in past years.

When rates are reduced, CLRC said the reduction almost always applies only to wages. Fringes are left unchanged. Most wage reductions amounted to 10% to 20% or, in dollars, from $2/hour to $3.50/hour.

CLRC has been unable to accurately document all instances of below-scale work. It does state, however, that all construction trades are involved. In some areas almost all work, with the exception of major projects, qualifies for reduced rates. In others, only a few narrowly defined projects are included. Generally, the smaller the project, the greater the likelihood it will be worked at a reduced rate.

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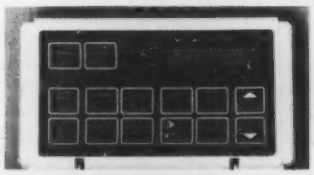

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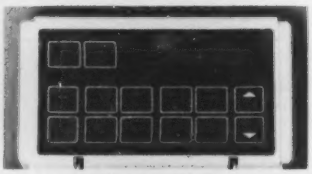

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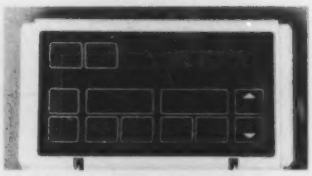

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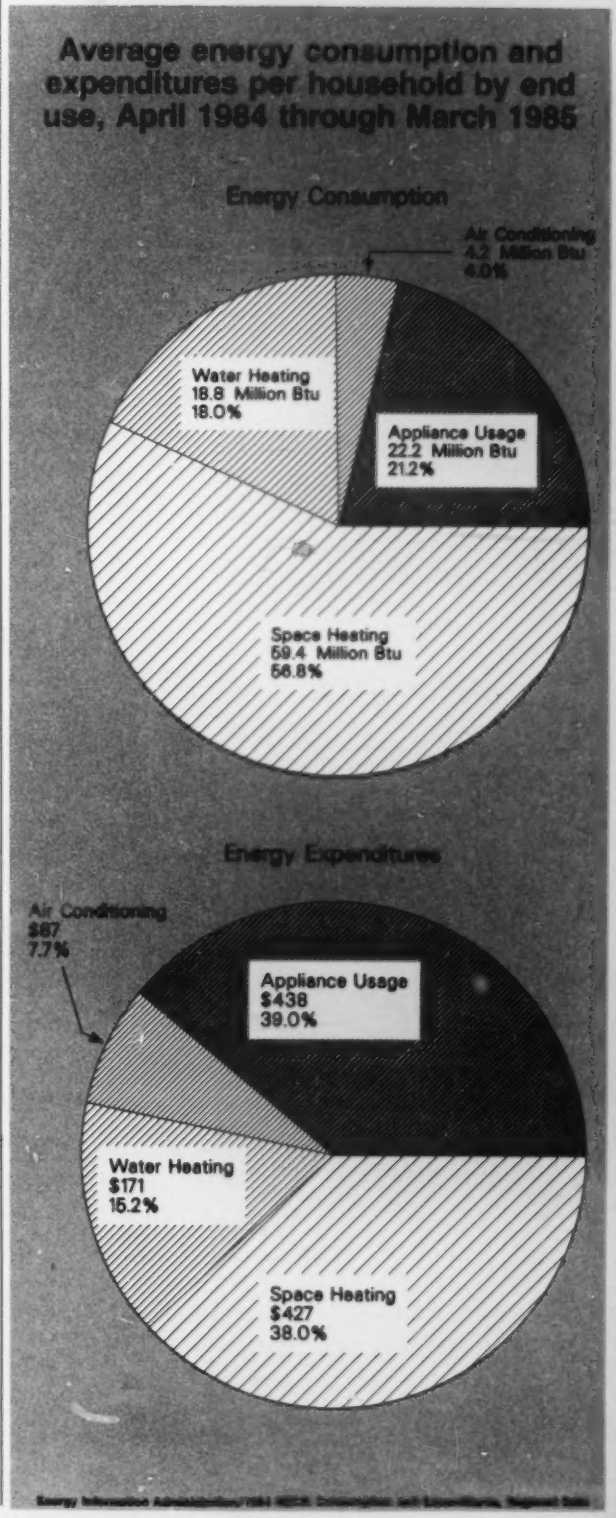

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